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# SARGENTIA

A CONTINUATION OF THE
CONTRIBUTIONS FROM THE ARNOLD ARBORETUM
OF HARVARD UNIVERSITY

VI

## THE BOTANY OF SOUTHWESTERN MACKENZIE

BY

HUGH M. RAUP

WITH THIRTY-SEVEN PLATES AND SIXTEEN
TEXT-FIGURES

PUBLISHED BY
THE ARNOLD ARBORETUM OF HARVARD UNIVERSITY
JAMAICA PLAIN, MASS., U. S. A.
1947

HARVARD UNIVERSITY

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H pl. 1-37

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Issued February 28, 1947

PRINTED IN UNITED STATES OF AMERICA BY
LANCASTER PRESS, INC., LANCASTER, PENNA.

# THE BOTANY OF SOUTHWESTERN MACKENZIE

HUGH M. RAUP

*with thirty-seven plates and sixteen text-figures*

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## INTRODUCTION AND ACKNOWLEDGMENTS

THE BROAD outlines of the botany of boreal America began to take form in the first half of the nineteenth century, particularly in the works of Sir John Richardson and William J. Hooker. Not since that time, with the exception of John Macoun's "Catalogue of Canadian Plants," have any attempts been made to prepare general descriptions either of the flora or of the botanical landscapes. The necessity for more intensive studies and the difficulties of travel have required rather that the work should be carried on in parts, looking forward to a more comprehensive revision of earlier concepts when the whole region should have been examined in some detail. The consummation of such a revision has been rendered increasingly complex in recent years by the development of new techniques for the study of the plant cover, and new viewpoints in the fields of biogeography and taxonomy. These new techniques and viewpoints have required that the whole structure be re-examined constantly in order to bring modern interpretations of taxonomic and geographic phenomena into line with progress in related fields.

It was to be expected that more intensive study should be subdivided on a geographic basis, examples of which, as they apply to the Mackenzie drainage basin, will be noted below. The present paper deals with one of these geographic areas, in the southwestern part of the District of Mackenzie (Northwest Territories), and may be divided roughly into four parts. The first is a general description of the region—its topography, geology, soils, and climates so far as they are known, together with a review of exploratory history. Second is an account of the plant communities that together form the botanical aspects of the landscapes. Third is a study of the geographic affinities of some species and communities, with an attempt to apply to the problem the recent hypotheses of Fernald and Hultén concerning the development of boreal vegetation in post-Pleistocene time. Finally there is an annotated catalogue of the vascular plants known to occur in southwestern Mackenzie.

The area treated in this paper is bounded on the west and south by the borders between the District of Mackenzie, Yukon, British Columbia, and Alberta. On the east it extends to the Slave River, Great Slave Lake, and Marian River. Its northern boundary is approximately at lat. 64° 30′, making the northern limit on the Mackenzie River a short distance above Norman (see *Fig. 1*). These boundaries originally were selected not because they had great botanical significance but because they enclose an area not covered by any previous or current investigations. Nevertheless, as will be shown subsequently, the western

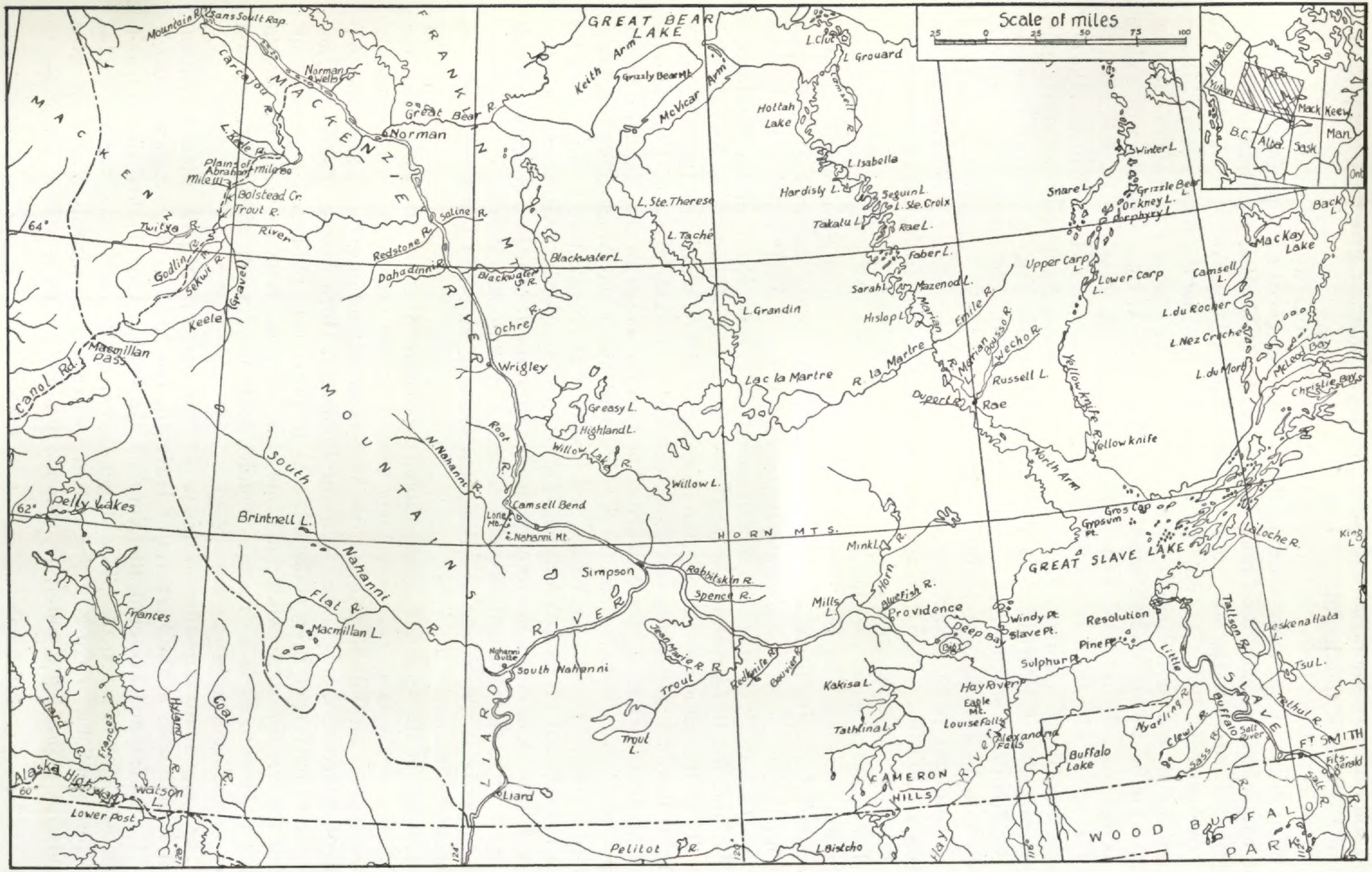


FIG. 1. Map of southwestern Mackenzie and adjacent regions.

and southwestern boundaries prove to be of considerable geographic importance from a botanical standpoint.

The Great Bear Lake and lower Mackenzie regions will be treated by A. E. Porsild in his forthcoming Flora of the Northwest Territories, preliminary notes for which have already been published (Porsild, 1937, 1943). Botanical investigations in areas to the south and southeast have been reported upon in some of my own papers (1930, '33, '34, '35, '36, '42, '45C), while the region of the Alaska Highway in northern British Columbia will be the subject of papers growing out of the field work of 1943 and 1944 (Raup, 1945A, B). The flora of Yukon is being studied and published upon at the present time by Dr. Eric Hultén (1941–45). The flora of southeastern Yukon, however, immediately adjacent to the area discussed in the present paper was almost completely unknown until 1944, when A. E. Porsild made extensive collections along the Canol Road between Johnson Crossing and Norman Wells. Mr. Porsild's main report, now in preparation, will make a highly significant contribution to our knowledge of the flora and plant geography of northwestern America. However, he has already published (1945) an account of his collections from the eastern slopes of the Mackenzie Mountains.

The material basis for the present studies is principally in three collections. The first was made by Dr. James H. Soper and myself at Fort Simpson and at Brintnell Lake in the Mackenzie Mountains during the summer of 1939 (see Raup, 1939). The second is a collection made by A. E. Porsild on the eastern slopes of the Mackenzie Mountains along the Canol Road in the autumn of 1944, and the third was made by Dr. V. C. Wynne-Edwards of McGill University in the same area during the summer of 1944 (see A. E. Porsild, 1945). I have also had access to a few small collections, notably those of E. A. Preble and Merritt Cary along the Mackenzie and on the slopes of the Nahanni Mountains, of C. L. Crickmay and F. S. Nowosad along the Mackenzie and lower Liard rivers, of Onion, Kennicott, and Hardisty at Great Slave L. and along the Mackenzie, and of Brooke, Hume, Howe, and Bedford at Great Slave Lake. Also I have examined numerous duplicates from the Richardson collections made at the time of the first and second Franklin Expeditions and now to be found in the herbaria at the New York Botanical Garden, Harvard University, and the National Museum of Canada.

The list of the vascular plants cannot be regarded as in any sense complete. A glance at the map will show huge areas that are yet unexplored botanically. This applies not only to most of the Mackenzie Mountains, but also to the outlying Cretaceous plateaus that form the Eagle and Horn Mountains, from which no plants have ever been collected. As in previously published lists of plants from the northwestern wilderness, my chief aim has been to bring up to date what is known, so as to form a sounder basis for further work and a clearer idea of the lacunae in our knowledge.

The range maps published in this paper [1] are based principally upon specimens that I have seen in the herbaria at Harvard, the New York Botanical Garden, the U. S. National Museum, the National Museum of Canada, and the Philadelphia Academy of Sciences. The ranges have in many cases, however, been filled in from published records. The extent to which such records should be used is always a problem; and it is common practice either to allow the maps to

[1] The base map used for these ranges is by J. Paul Goode and is copyrighted and published by the University of Chicago Press.

stand upon specimens alone, or to include unverified data designated by suitable symbols. I have preferred in the present instance to show the stations as of uniform validity, trusting to care in the selection of published records for the elimination of error. The rules used in this selection are few and simple. In cases of some rare species, and of species whose determination is difficult and controversial, no unverified records were admitted. Records far outside what appear to be the "range patterns" of species were scrutinized carefully even if specimens were available, and if the records were unsupported the stations were put in with question marks. Recent monographic treatments usually have been accepted at face value, though with reservations in cases of unusually controversial groups. The floristic works most heavily relied upon are those done in recent years by students who have had access to large collections and libraries, though data on well-defined, long-established species have been accepted freely from less authentic sources. The following are the papers most frequently consulted in the preparation of the maps.

*Aleutian Islands, Alaska, and Yukon:* Hultén, 1937A, B; Hultén, 1941–45; Porsild, 1939; Scamman, 1940; Anderson, J. P., 1943–45; Britton and Rydberg, 1901.

*British Columbia, Western Alberta, Washington, and Montana:* Henry, 1915; Rydberg, 1922; Macoun, John, 1877; Raup, 1934, 1942; Dawson, 1881, 1888A; Jones, 1936, 1938; Piper, 1906; St. John, 1937; Standley, 1921; Farr, 1907.

*Mackenzie, Keewatin, Alberta, Saskatchewan, and Manitoba:* Porsild, A. E., 1937, 1943; Macoun & Holm, 1921; Raup, 1934, 1935, 1936, 1942; Grøntved, 1936; Güssow, 1936; Störmer, 1933; Rydberg, 1932; Hooker, 1829–1840; Preble, 1908; Macoun, J. M., 1896, 1911; Tyrrell, J. W., 1902; Tyrrell, J. B., 1896, 1897.

*Labrador and the eastern Arctic:* Polunin, 1940; Potter, 1934; Abbe, 1936; Woodworth, 1927; Wetmore, 1923; Bishop, 1930; Marie-Victorin, 1935; Raup, 1943; Simmons, 1906, 1913.

*Greenland:* Porsild, M. P., 1932; Böcher, 1933A, B; Gelting, 1934.

*General:* Macoun, J., 1883–1890; Fernald, 1925.

The field work of 1939 upon which much of this report is based, and without which it could not have been prepared, was supported by generous grants from several institutions and persons, to all of whom I am deeply grateful. The cost of the expedition was met by grants from the Milton Fund at Harvard, the General Science Fund of the American Academy of Arts and Sciences, and the Alexander Dallas Bache Fund of the National Academy of Science. Valuable field equipment was kindly loaned by the National Museum of Canada. Personal contributions were made by an anonymous donor and by Mrs. Mary G. Henry, whose interest in northwestern botany has been unflagging, and whose pioneering field work in northern British Columbia is well known.

In the study of the material I have had much assistance and inspiration from Mr. A. E. Porsild, Chief Botanist at the National Museum of Canada. He has not only placed at my disposal a large amount of data on the flora of the eastern slopes of the Mackenzie Mountains, but has also examined much of our material in the light of his extensive knowledge of the whole flora of western arctic Canada and Alaska. Furthermore his accumulated data on the ranges of arctic plants have been made freely accessible to me for the filling in of gaps on the maps.

Several students of special groups have been kind enough to examine specimens representing their particular fields. Dr. C. L. Hitchcock has looked over our specimens of *Draba;* Dr. Bassett Maguire, *Arnica;* Dr. I. M. Johnston, Boraginaceae; Mr. C. A. Weatherby, the ferns and fern-allies; Dr. Bernard Boivin, *Thalictrum;* and Dr. Edgar T. Wherry, *Polemonium.* Professor M. L.

Fernald has, as usual, been a constant source of ideas and assistance in the study of the flora. Dr. E. C. Abbe of the University of Minnesota has very kindly permitted me to make use of his unpublished data from the east coast of Hudson Bay for filling in the maps. I am indebted also to the authorities of the New York Botanical Garden and the United States National Museum for access to their material. Dr. William R. Maxon of the latter institution was especially helpful in getting out a list of the Preble and Cary collections. Professor Kirk Bryan of Harvard has very kindly read and criticized the geological parts of the paper.

It is impossible to mention individually all the people who helped to forward the field work. Mr. Harry Snyder of Montreal placed at our disposal indispensable information about the Brintnell Lake country, with copies of the manuscript map of the lake and its environs made during his expedition of 1937. Officials of the Hudson's Bay Company and the Mackenzie Air Service were, as usual, most helpful in organizing our supplies and transportation. It is impossible to express too great appreciation of the kindness and hospitality of our many friends at Fort Simpson. They made our stay there thoroughly comfortable and a continuous delight. Special thanks are due to Archdeacon and Mrs. Harry G. Cook who took us into their home, and to Capt. George Isbister who was in charge of the Government Radio Station. Infinite patience on the part of Capt. Isbister made it possible for us to maintain radio contact with Simpson throughout the summer.

Finally it is a pleasure to express my obligation to my wife and to Dr. James H. Soper, field companions of the expedition of 1939. Without their unfailing patience, enthusiasm, and good will, the measure of success achieved would have been impossible.

## THE TOPOGRAPHY OF SOUTHWESTERN MACKENZIE

The most prominent topographic feature of southwestern Mackenzie is formed by the Mackenzie Mountains, which lie along its western border. These mountains appear to be a part of the Rocky Mountain system, but their central axis is displaced eastward from that of the latter. The Rocky Mountains of northern British Columbia recede to low elevations in the plateau country of the upper Liard River. This plateau "extends eastward, right through to the Great Plains region, between the extreme north of the Rocky mountains and the southern end of the Mackenzie mountains. These two groups of mountains do not lie in tandem; they lie in the same northwesterly strike, but Mackenzie mountains are offset by a gap that centres about the mouth of Fort Nelson river and opens out to the southeast" (Camsell, 1936).

The Mackenzie Mountain system begins at the Liard River and extends in a northwesterly direction in a great arc some 600 miles long. According to Camsell (l. c.) it covers an area of 75,000 to 100,000 square miles and is regarded as the largest mountain group in Canada. Keele's description (1910), made as he crossed the range from west to east by way of the Ross and Gravel Rivers, will serve to characterize the topography.

The mountains as seen from the west present a massive and continuous front, unbroken by lowland areas. The crestline is uneven in profile, however, and the course of the ranges varies, with subdued types of mountains among the more rugged ones. The structure is characterized by folding on a broad scale, with

the folds sometimes close-set or overthrust. The western slopes are trenched by wide valleys that cut well back to the divide. Both hard and soft strata appear, and to some extent have determined the major topographic features, though the main drainage channels cut through both hard and soft rocks. The higher, more rugged mountains are granite stocks which have resisted weathering much better than the intervening sedimentary rocks. Glacial erosion and deposit have greatly modified the surface features, smoothing the bedrock and strewing the valley floors and lower slopes with drift and outwash. In this western part of the range the mountains are commonly over 7000 feet high, and a few reach 9000 feet.

"About forty miles east of the divide the topography changes in a marked degree, and a more compact and rugged mountain region is entered. The drainage channels of this region are confined in narrow valleys, with steep, barren slopes of rock and talus, the rivers in the bottom flowing in a very contracted bed, which at rare intervals opens out into a narrow alluvial flat.

"The structure of these mountains differs from that of the ranges to the west, being apparently due to fracturing, buckling and faulting of the strata, and the residual masses present the appearance of a series of faulted and tilted blocks. The principal lines of fracture are in a northwest-southeast direction, and the beds have a prevailing southwesterly dip.

"Escarpments produced by tilted strata, overlooking fault valleys, are the most prominent features, but they do not appear to persist in alignment for any great distance.

"The highest peaks are roughly pyramid-shaped masses, carved from the harder of the stratified rocks of which the mountains are built. They vary in elevation from 6,500 to 7,500 feet, with a height above Gravel river of 3,500 to 6,000 feet. The denudation of these mountains has not reached such an advanced stage as that exhibited by those to the westward; the valleys are narrow and steep-sided, and the grade of the drainage channels is much steeper.

"The Mackenzie mountains, as a whole, have a maximum width of about 300 miles; there is no well-defined crest line, but they appear to be rather a complex of irregular mountain masses, which are the result of deformation and uplift. The topography of the western portion bears evidence of long-continued differential erosion, while the eastern portion has the appearance of being a more youthful topographic stage. Both in geology and structure the eastern portion of these mountains is closely related to the Rocky mountains in southern Canada."

"A portion of the drainage of the western slope of the Mackenzie mountains falls into the Frances river, and thence by the Liard and Mackenzie rivers into Beaufort sea, but the greater part is taken by tributaries of the Yukon river to Bering sea. All the drainage of the eastern slope falls into the Mackenzie river.

"There is a great disparity both in river development and stream grades between the two sides of the divide.

"On the western slope the water flows from near the divide, for a long distance, through valleys of mature erosion with an easy grade before reaching the master stream, the Yukon; while the streams on the eastern slope fall rapidly for a comparatively short distance and reach a much lower level at their junction with the Mackenzie. For example, the Ross and Pelly rivers have a combined length of 450 miles, and enter the Yukon at an elevation of about 1.500 feet above sea-level, while the Gravel river, 255 miles long, enters the Mackenzie at a height of about 200 feet above sea-level.

"Owing to the great difference in precipitation the streams from the west side of the divide carry down to the Yukon more than twice as much water as the streams over an equal area on the eastern side. Thus the Gravel river and its branches do the work on the eastern side of the divide, while the combined efforts of the Hess, Macmillan, and Ross rivers are required to carry the water from the western slope; the Gravel river being about equal in volume to the Macmillan" (Keele, 1910).

Keele's delineation of two types of topography in the Mackenzie Mountains is borne out by more recent observations on the route of the Canol Road and farther south in the South Nahanni River country. In fact the South Nahanni appears to separate the two types, at least in its upper course. Flying west from Simpson, one comes rather suddenly to the front range, and then passes over a mountain mass whose summits, seen on the skyline, make a fairly even plain. The tops commonly show a rolling surface with rounded contours, broken by sharp cliffs and steep slopes into the deep valleys. This is the topography described by Keele along the Gravel River, though west of Simpson it is not so high. Porsild (1945) saw it at the "Plains of Abraham" about 80 miles west of Norman Wells. The high granite peaks of the western elements of the range appear west of the upper South Nahanni (see below), and apparently correspond to those seen by Keele in the Christie Pass area.

The maximum height attained by the Mackenzie Mountains is as yet unknown. A granite peak at Brintnell Lake has been estimated with reasonable accuracy at about 8500 feet, while still higher elevations have been reported between there and the Gravel River, as well as northward in the Bonnet Plume River region.

Some further discussion of the mountain topography will be found in the description of vegetation in the Brintnell Lake region.

East of the Mackenzie Mountains lies a northern portion of the central continental plain. It is composed of two principal elements in our region: the Alberta Plateau and the Mackenzie Lowland. These are bounded on the east by the Laurentian Plateau (see Camsell & Malcolm, 1921). The Alberta Plateau is represented only in the southern part. Its northern boundary extends "from near Fort Smith on Slave river northwesterly along the south side of Great Slave lake and thence at an equal distance along the Mackenzie river to the Liard in longitude 122 degrees. Here the escarpment is lost, although from McConnell's observations it may swing southwest along the valley of Liard river." The northern margin of the plateau is a well-defined fall-line for streams draining in that direction. Its surface is gently rolling, and marked by glacial deposits of various kinds with an abundance of lakes. The drainage is immature, with sluggish streams and many muskegs. "The top of the escarpment is about 400 feet above the level of the adjacent lowland, and the surface then rises gradually southwest and west to the foothills of the Cordillera" (Camsell & Malcolm, 1921). Southwest of Great Slave Lake the plateau surface is about 1100 feet above sea-level.

A plateau of similar nature borders the Mackenzie Mountains at the northeast. It has been called the Peel Plateau by Camsell (1906; see also Camsell & Malcolm, 1921), and occupies the upper valley of the Peel River between the Richardson and Mackenzie Mountains.

The Mackenzie Lowland, through which the Mackenzie River flows northward to the Arctic, is bounded on the south and west by the Alberta Plateau escarpment and the Mackenzie Mountains, while to the east it abuts against the

Laurentian Plateau. In general it is a broad plain of low relief, with a gradual slope (about 8 inches to the mile, according to Camsell and Malcolm) northward to the Arctic coast. "The surface as a rule does not stand much above the main water-courses or the great lakes and the banks of these are rarely more than 200 feet in height." There are of course long extensions of the lowland up the valleys of the larger rivers such as the Slave and Liard. Its surface in general is poorly drained, with most of its streams leading toward the Mackenzie. Muskegs and lakes abound.

Three other topographic features of southwestern Mackenzie should be noted. Two of these are low plateaus that rise above the general level of the central plain. The Horn Mountain Plateau lies about 20 miles north of the Mackenzie between Providence and Simpson. Its surface is about 2500 feet above sea-level and is said to be covered with muskegs and ponds (Whittaker, 1922, 1923). The Eagle Mountain Plateau is southwest of Great Slave Lake and west of the Hay River. It also reaches an elevation of about 2500 feet (see Cameron, 1922). Horn Mountain and presumably also Eagle Mountain are capped by Cretaceous rocks and correspond to the Caribou, Birch, and Watt Mountain Plateaus farther south.

A third elevation above the central plain is the range known as the Franklin Mountains. It more or less parallels the Mackenzie from a point near the mouth of Willow Lake River northward beyond Great Bear River. Between Willow Lake River and Wrigley the range "consists of sharp, but open, southerly plunging folds, the axes of which control the trend of the river. Just north of Willow Lake river, two ranges, about 10 miles apart, appear to represent the east and west limbs of an eroded anticline, although it has not been established that there are no intervening folds. The easterly ranges die out 4 or 5 miles north of the latitude of Fish Lake river, the westerly range where traversed by this river containing an open anticlinal axis, with its eastern limb truncated. Farther north, due to the rising axis, older formations are exposed and the mountains are high and more complex, and cover a broader belt.

"At Smith creek the western range has split into two, the eastern branch being subdivided into several irregular ridges, extending in different directions. Opposite Wrigley, the Roche-qui-trempe-à-l'Eau forms the westernmost ridge of the Franklin system. Four miles to the east the mountains rise as a somewhat dissected mass, which may be grouped into two main ranges, with another which forms the easternmost part of the system, dying out to the north . . . Cap Mountain [northeast of Wrigley], . . . consists of a quartzite ridge dipping steeply to the west and rising in elevation at its northern end where it forms the highest mountain of the Wrigley region—its height being estimated at more than 5000 feet above sea-level" (Williams, 1922).

"The western border of Franklin mountains, from the vicinity of Wrigley to Saline river, is from 6 to 8 miles east of Mackenzie river. Exceptions occur in the case of Roche-qui-trempe-à-l'eau; a small mountain ridge bordering the Mackenzie 1½ miles below Wrigley; and of low mountains situated 3 miles east of the Mackenzie in the vicinity of Blackwater river. For 40 miles south of Great Bear River, Franklin mountains are represented by a chain of about six isolated knobs, none of which appears to rise more than 1000 feet above Mackenzie river. Mount Charles, situated on the north bank of Great Bear river, is a continuation of this chain, and rises about 1440 feet above Great Bear river and probably 1500 feet above Mackenzie river" (Williams, 1923).

Great Bear River, which connects Great Bear Lake with the Mackenzie, has cut its valley directly through the Franklin Mountains. Several other streams, such as the Blackwater, rise in a lake country east of the range and have cut deep valleys through it almost at right angles.

A minor elevation above the Mackenzie lowland is about 10 miles back from the river and some 35 miles north of Simpson. It is plateau-like and is called the Ebbutt Hills, about 1500 feet above the river level. Its top is said to be covered with muskeg (Williams, 1922).

This brief discussion of the topography of the area will furnish a setting for the following descriptions of exploratory history, geological formations, and soils. It must be remembered that vast stretches of country away from the main rivers and lakes remain to be explored, so that detailed topographic accounts are impossible except in a few places.

## HISTORY OF EXPLORATION

The first white men to visit southwestern Mackenzie were those in Alexander Mackenzie's exploring party of 1789. The narrative of this expedition gives the course of the Slave and Mackenzie Rivers, outlines parts of the northwest shore of Great Slave Lake, and gives the approximate position of the Caribou, Horn, Eagle, Mackenzie, and Richardson Mountains. It is filled with observations on the plant and animal life of the region, as well as on the life of the aborigines. Mackenzie's voyage was designed to open the country for the fur trade, and the great river soon became the principal highway in this trade and the scene of its permanent establishments. No doubt a certain amount of exploration away from the main route was carried on by the traders, but no account of it is available. Even the explorations of Sir John Franklin and his parties (Franklin, 1823, 1828), which made such outstanding contributions to the geography of the northwest, added little to the knowledge of our region. They passed through it only as Mackenzie did, by way of the main river.

Attempts to use the Liard River as a trade route into the Cassiar region and the upper Yukon proved futile, due to the difficulties of navigation. Part of the upper Liard country was visited by the Hudson's Bay Company trader Robert Campbell, who traveled down the Dease and up the Liard and Frances Rivers to Frances Lake in 1840. Campbell established a route from Frances Lake into the upper Pelly River by which he reached the Yukon. He is known to have made a journey from the Yukon to Fort Simpson by this route and the Liard River in 1852 (see Dawson, 1889, for a discussion of early travels on the Yukon and upper Liard Rivers). The expense and risk of navigating the Liard through the Rocky Mountains, however, forced the traders to give it up, and the posts of the upper river were then supplied from the Pacific Coast.

It is unnecessary to enumerate all the travelers who have contributed to the description of the upper Mackenzie River country, though a few outstanding ones will be mentioned. Richardson's account of his Franklin search expedition of 1848 (Richardson, 1851) is of particular value because of its general notes on all of the Mackenzie basin. His collections made at the time of the Franklin expeditions were described by W. J. Hooker (1840), while his general observations on natural history are to be found not only in his appendices to the Franklin narratives and in the narrative of his journey of 1848, but also in other publications (1825, 1861). A few plants were collected in this period also by W. J. S.

Pullen along the upper Mackenzie. Pullen was a British naval officer engaged in the Franklin search. He spent two winters at Fort Simpson and traveled up to Great Slave Lake in 1852 (Pullen, 1852). His specimens were enumerated by Seemann in 1852–57.

Some valuable data on soil frost phenomena, as well as miscellaneous observations on the vegetation, were made by J. H. Lefroy in 1843 and 1844. He was commissioned by the Royal Society to gather magnetic data throughout the Mackenzie region, spending the winter of 1843–44 at Chipewyan and traveling northward as far as Fort Good Hope in the following summer (Lefroy, 1857, 1883, 1886).

In 1859–60 Robert Kennicott, a naturalist working under the auspices of the Smithsonian Institution and the Chicago Academy of Sciences, made a collecting trip through the Athabaska–Mackenzie country. He spent the autumn of 1859 at Fort Simpson, making a trip of three weeks up to Fort Liard. In the following winter and spring, after another journey to Fort Liard, he visited Forts Rae and Resolution on Great Slave Lake, and spent the summer of 1860 at the latter place. He then descended the Mackenzie and crossed into the Yukon by way of the Peel, Rat, and Porcupine Rivers. Kennicott made large zoological and botanical collections and was extraordinarily successful at inspiring the local traders to continue gathering material. A set of his plants is now in the herbarium of the New York Botanical Garden (see Kennicott, 1869).

Emile Petitot, a Catholic missionary, spent many years in the Athabaska–Mackenzie country, beginning about 1862. He published a series of papers between 1875 and 1893 devoted primarily to the geographic features of the country and its people. Few if any persons have ever traveled so widely in this region or written so voluminously about it. His personal observations appear to be thoroughly reliable, but they are so interspersed with hearsay and legend that sorting them out is often difficult.

More accurate descriptions of the surface features and geology of our region began to take form for the first time in the reports published by the Geological Survey and the Department of Interior of Canada in 1888, 1890, and 1891. These reports were based upon a series of remarkable survey journeys made in 1887 and 1888 by G. M. Dawson (1888), R. G. McConnell (1891) and William Ogilvie (1890). Dawson and McConnell went to Dease Lake in Northern British Columbia by way of the Stikine River and Telegraph Creek. From Dease Lake they descended the Dease River to the Liard, where McConnell left the main party and went down the latter stream. Dawson went up the Liard and Frances Rivers to Frances Lake, then into the Pelly River by way of the old trade route used by Campbell in the 1840's. He then descended the Pelly to the Lewes and returned to the coast by the latter stream and the Chilcoot Pass. Dawson's description of the western component of the Mackenzie Mountains in the vicinity of Frances Lake is the first authentic account of the Mackenzie range that is available.

McConnell surveyed the Liard to its junction with the Mackenzie in the summer of 1887, and then spent the autumn of that year in the country along the Slave, Salt, and Hay Rivers. He wintered at Fort Providence, making journeys to Fort Rae in the north arm of Great Slave Lake. In the summer of 1888 he descended the Mackenzie and made the traverse to the Yukon by way of the Peel and Porcupine. He returned to the coast by the Yukon and the Lewes.

Ogilvie spent the winter of 1887–88 on the Yukon, and then ascended the

Tat-on-duk River to its head and crossed a height of land to the headwaters of the Porcupine. Then he went down the Porcupine and up the Bell to the Trout River, a western tributary of the Peel. He reached the Mackenzie by way of the Peel, and returned southward through the Mackenzie basin.

As a result of these three expeditions the Mackenzie River was more accurately mapped, the Liard was surveyed for the first time up as far as the Frances, and the configuration of the Mackenzie Mountain mass began to appear in its true form. Also the broad outlines of the geology of the region were formulated. All of the reports are filled with pertinent notes on the vegetation and its distribution—particularly that of Dawson, who was one of the most discerning naturalists ever to visit the Northwest. As appendices to his report he published a classic essay on the distribution of trees and shrubs in Yukon and adjacent British Columbia (see also Dawson, 1888B), a list of plants collected on the journey, as well as notes on Indian tribes, zoological collections, rocks, and astronomical and meteorological observations. For many years the plants collected by him were the only specimens available from the vast inland region of northern British Columbia and southern Yukon. Most of them are now to be found in the National Herbarium of Canada.

The period of gold discovery in the Cassiar Mountains (in the 1870's) and the later one in the Yukon region (1898) occasioned a great deal of travel and exploration along the Liard and Peel Rivers. Many gold-seekers tried to reach the Yukon by these routes, some successfully and some disastrously. (See the reports by Dawson and McConnell cited above; also Graham, 1935 and Keele, 1910.) According to Keele, one of the parties crossed the Mackenzie Mountains by way of the Gravel and Hess Rivers. Very few of these travelers ever published adequate descriptions of the country they traversed so laboriously. Another crossing of the Mackenzie Mountains in 1898 is reported by Keele. This was made by a trader with a party of Indians from Fort Good Hope, who started a post on the western side of the divide at the Stewart River.

In 1892 Miss Elizabeth Taylor traveled down the Mackenzie by the usual route, making collections of natural history specimens. No published narrative of her journey has come to light, but her collections are well known and have been published upon by several students. Most of the plants are to be found in the herbaria at the National Museum of Canada, the New York Botanical Garden, and at Harvard. They bear excellent data as to locality and date, but unfortunately most of the collection was numbered serially by specimens, with some duplication and omission of numbers, so that duplicates cannot now be recognized by the numbers alone.

A zoological collector, Frank Russell of the University of Iowa, worked at Great Slave Lake and along the Mackenzie in 1893 and 1894. His report, published in 1898, contains many valuable notes on forests and other types of vegetation. He is one of the few travelers who have described any part of the semi-open prairie country between Providence and Rae.

The map of the western and northern arms of Great Slave Lake was greatly improved by Ogilvie (1890) and McConnell (1891), and pioneer geological reconnaissance was done by McConnell especially around the western arm. The first comprehensive geological reconnaissance at Great Slave Lake, however, was made in 1899 by Robert Bell and his assistant J. M. Bell of the Canadian Geological Survey (R. Bell, 1900; see also J. M. Bell, 1929). The significance of ancient shore lines around the lake, pointed out by McConnell, was discussed

at somewhat greater length by Bell, who saw them in the eastern as well as the western arms.

The first comprehensive biological investigation in the upper Mackenzie River region was done by E. A. Preble and his associates of the United States Biological Survey in 1903–04 (Preble, 1908). After an earlier trip in 1901 to Great Slave Lake, Preble returned to Resolution in the spring of 1903, accompanied by his brother, A. E. Preble, and Merritt Cary. Cary and A. E. Preble spent the summer of 1903 collecting along the south shore of Great Slave Lake, and along the Mackenzie down as far as Wrigley. Their chief bases were Hay River, Providence, Simpson, the mouth of the North Nahanni River, and Wrigley. While at the Nahanni they climbed Nahanni Mountain. They returned to the United States in the autumn. Meanwhile E. A. Preble went up the north arm of Great Slave Lake and through a chain of lakes to Great Bear Lake. He descended Great Bear River to Norman, and went up the Mackenzie to Simpson where he spent the winter of 1903–04. In the following summer he continued his work down the Mackenzie to the Peel and Fort McPherson, and then returned southward by the usual river route. Preble's report, though concerned largely with the animals of the region, is a veritable mine of biological information on the whole Mackenzie basin. It also contains excellent general descriptions of physiographic features, climate, and vegetation, with exhaustive accounts of exploratory history. Some of the principal biogeographic boundaries in the region had already been pointed out by Richardson, but it remained for Preble to define them more accurately and to map them according to the Merriam life-zone concept. Plants collected by the Preble expeditions are to be found in the United States National Herbarium at Washington. An annotated list of trees and shrubs was published in the report of 1908, but the herbaceous species have never been listed except in the accession records of the National Herbarium.

A crossing of the Mackenzie mountains was first described by Joseph Keele, of the Canadian Geological Survey (1910). Some of the western approaches to the mountains were surveyed by McConnell in 1902 on the Macmillan River (McConnell, 1906) and by Keele in 1904 on the upper Stewart River (Keele, 1906). In the summer of 1907 Keele made a reconnaissance survey along the Pelly up to about 140 miles above its junction with the Ross River. He then ascended the Ross to its headwaters, where he found a mountain pass to the head of the Gravel River, which he descended to the Mackenzie. The journey through the mountains required the entire winter and spring of 1907–08. Keele's report is a mine of first-hand information on the topography, climate, flora, fauna, Indians, and geological structure of the Mackenzie Mountains. Until very recently it was the only source of data on this little-known wilderness. I have drawn upon it frequently and at length during our field work of 1939 and in the preparation of the present paper.

The Ogilvie Mountains were crossed by Camsell in 1905 by way of the Stewart River, Braine Creek, Nash Creek, and the Wind River. His report (1906), like that of Keele, contains a wealth of data on the natural history of the country. The physiographic province known as the Peel Plateau was first adequately described as a result of this survey.

More intensive geological survey work around the western arm of Great Slave Lake and along the upper Mackenzie was begun in 1916 by parties sent out from the Canadian Geological Survey. A. E. Cameron was in charge of work around

the lake and in the valleys of the Hay and Buffalo Rivers during the summers of 1916 and 1917 (see Cameron, 1917, 1918, 1922B; also Hume, 1921). His paper on post-Glacial Lakes in the Mackenzie basin (1922A) was based in part upon observations made during these years.

The years between 1920 and 1923 saw a great deal of geological survey activity along the upper Mackenzie, largely inspired by the discovery of oil in the Norman area. A report on the district between Great Slave Lake and Simpson was published by E. J. Whittaker (1922); between Simpson and Wrigley by M. Y. Williams (1922); on the North Nahanni and Root River areas by G. S. Hume (1922); between Providence and Simpson by Whittaker (1923); on the northern part of the Franklin Mountains by Williams (1923); the Redstone–Dahadinni Rivers area by Hume (1924); and on a part of the lower Liard River by Hume (1923). The geology of the Norman area was described by Hume in 1923, and by E. M. Kindle and T. O. Bosworth in 1921. A general account of the geological structure of the whole Mackenzie River region was published by D. B. Dowling in 1922.

A large amount of purely geographic information resulted from these surveys, particularly for the eastern approaches to the Mackenzie Mountains and for the Franklin Range east of the river. It was in this period also that the Survey began to use a route to the upper Mackenzie by way of Fort St. John, B. C., and the Sikanni River. Their parties went to Peace River Crossing by rail and then up to Fort St. John by boat. Here they took pack horses and traveled northward to the Sikanni River, where they built scows. With the scows they floated down the Sikanni and Nelson Rivers to the Liard and then to Simpson. The advantage of this route was that the parties and their equipment could be on the scene of the season's work about a month before the opening of navigation on Great Slave Lake, thus lengthening the possible field season by approximately a third.

Although many useful notes on the occurrence of forest types are to be found in the above reports, only a few plant collections were made. For the most part they were gathered by such members of the field parties as had the requisite interest. Brooke, Howe, and Bedford brought specimens from the southwest and north shores of Great Slave Lake, and Bedford collected a few in the country north of the north arm. One of the best collections was made by C. L. Crickmay, an assistant to M. Y. Williams in 1922 along the lower Liard and upper Mackenzie. Later, in 1945, Crickmay made another small collection in the Franklin Mountains. In 1944 Mr. F. S. Nowosad of the Canadian Department of Agriculture brought a small but interesting collection from the lower Liard and upper Mackenzie. All of this material is to be found in the National Herbarium of Canada.

Three short papers by E. M. Kindle (1918, 1920, 1921), derived from observations made during his geological work on the Mackenzie, are of particular interest from a phytogeographic standpoint. They deal with recent sedimentation along the main rivers of the Mackenzie basin, and with the arrival and departure of winter conditions.

New maps of Great Slave Lake and of the Mackenzie and Slave Rivers were made by the Canadian Topographical Survey during the 1920's. G. H. Blanchet was in charge of the parties operating on Great Slave Lake, and he wrote an

excellent description of the lake and its environs (Blanchet, 1926). Most of the region has now been photographed from the air, with new maps printed or in preparation.

My own field work in the Athabaska–Great Slave Lake region has touched the area treated in this paper only on two occasions. In 1927, en route to Great Slave Lake, I made a few collections and notes along the lower Slave River, and in 1929 our field party crossed from the mouth of Salt River to the Little Buffalo by wagon, and made a canoe journey up the latter stream to Conibear (Moose) Lake. Such collections as were available from the northern part of the Wood Buffalo Park (north of lat. 60°) were incorporated in my botanical paper on the Park (1935), while some descriptions of its vegetation types and the affinities of its flora are to be found in two earlier papers (1930, 1933). The floristic and vegetational features of the whole region around Athabaska and Great Slave Lake were presented in two later papers (1936, 1946). Some further contributions to our knowledge of the vegetation in the northern part of the Wood Buffalo Park are to be found in an excellent paper by J. D. Soper on the History, Range, and Home Life of the Northern Bison (1941). Mr. Soper spent two years in the Park area (1932–34), traveling extensively and making a general study of the biota.

Since the exploratory activity of the Geological Survey of Canada along the Mackenzie and lower Liard in 1920–22, the most important work in our region has been done in the Mackenzie Mountains. F. A. Kerr, a mining geologist, published a short note on the topography and geology of the South Nahanni–Frances River district in 1934; and the South Nahanni up as far as Virginia Falls was examined by A. E. Cameron in 1935 (see Cameron, 1936, 1938). Both of these men refer to maps of the South Nahanni made by Fenley Hunter in 1928, and of the Flat River country by R. M. Paterson about the same time, but I have been unable to find reproductions of them.

Two papers, published in 1936 and 1937, are of particular interest to the phytogeographer. Dr. Charles Camsell (1936) made a journey by plane from Prince Rupert to Wrangell, and thence to Dease Lake. From here he flew eastward over the plateau region of the upper Liard, and down to the Mackenzie. His brief paper describing the flight contains some excellent photographs and an account of the geography of this unexplored wilderness as seen from the air. He points out, for the first time, the continuity and wide extent of the great forested watershed of the upper Liard basin. It is this forest that appears to isolate the alpine vegetation of the Mackenzie Mountains from that of the Rockies. R. M. Anderson (1937) at once saw the zoogeographic significance of the "Liard gap," and emphasized its importance as a connecting route between the "Canadian zone" fauna of the Mackenzie basin and that of the Yukon.

In 1937 Mr. Harry Snyder of Montreal took a survey party to Brintnell Lake (shown on some maps as Glacier Lake), a small body of water near the head of the South Nahanni River. The South Nahanni is exceedingly swift and difficult of navigation, especially in its lower course. It flows in a deep canyon for a considerable distance, and at about 150 miles above the Liard it forms Virginia Falls, estimated to be about 300 feet high. The country on either side of the river is rugged and mountainous, making overland travel also difficult and time-consuming. Only a few hardy trappers and prospectors have ever penetrated the region by the ordinary means. Snyder had supplies and heavy

equipment taken up the river in barges as far as the falls, and then ferried both party and supplies to Brintnell Lake by air. Accompanying Mr. Snyder were Dr. George Goodwin, a zoologist from the American Museum of Natural History, and Mr. Fred Lambart, a surveyor. Triangulation points were set up on the lake shores, and a topographic map was made of the lake and of the mountains immediately surrounding it. This map was used to good advantage by our party in 1939, and is in part reproduced here as *Fig. 2*.

Aerial photographs of the South Nahanni from the Liard to Virginia Falls, of the valley of the Flat River, and of the Macmillan Lake country have been made in recent years, and maps have been drawn from them. The discovery of gold on the western tributaries of the South Nahanni has greatly increased interest in the region, and further exploration will no doubt go forward rapidly.

The Arnold Arboretum expedition of 1939 reached Fort Simpson on June 8, traveling by the usual steamer route from Waterways to Fitzgerald, and by air from Fort Smith to Simpson. Supplies had been shipped to Simpson in the preceding year. After about a week of collecting at Simpson, the party, equipment, and supplies were flown to Brintnell Lake in a chartered Mackenzie Air Service plane. We remained at the lake until the 20th of August, making collections of the flora and records of its local distribution and the structure of plant communities. Three weeks were then spent at Simpson, making further collections. The return to Waterways followed the usual steamer route. Some 15,000 herbarium specimens were gathered during the season, about two-thirds of which are of vascular plants and the remainder of lichens, mosses, and fungi. Duplicates from this material will be found in various herbaria (see Raup, 1939).

Exploration of the central part of the Mackenzie range has been enormously facilitated during the war by the construction of the Canol pipeline from Johnson Crossing at the north end of Teslin Lake to Norman Wells on the Mackenzie. A biological field party under the joint leadership of A. E. Porsild and A. L. Rand, of the National Museum of Canada, traversed the pipeline road in the season of 1944, making large collections which are now being worked up. Most of Mr. Porsild's botanical material was gathered on the western slopes of the mountains, in the Territory of Yukon, but early in September he made a rapid reconnaissance between Macmillan Pass and the Mackenzie, gathering such specimens as were still available so late in the season.

Also in 1944, Dr. V. C. Wynne-Edwards, of McGill University, was on the Mackenzie in connection with a study of fisheries. In late July he went up the Canol Road to the Bolstead Creek Pump Station and made a collection of plants from that vicinity. Earlier in the season he made another collection on the upper slopes of Nahanni and Lone Mountains, west of the Mackenzie River near the confluence of the North Nahanni; and he also gathered miscellaneous specimens along the Mackenzie itself at various times during the season. Mr. Porsild (1945) has published a list of his own and Wynne-Edwards' collections from the eastern slopes of the mountains, with descriptions of vegetation seen along the Canol Road in this sector. His records are included in the present paper, and I have drawn freely from his descriptive notes.

I am indebted to Dr. C. O. Hage of the Geological Survey of Canada for a small collection of plants made at Trout Lake on Aug. 13, 1944. So far as I am aware these are the only specimens available from the vast area beween the Mackenzie and Liard, on the north, and the 60th parallel on the south.

## GEOLOGY AND SOILS

### Pre-Glacial Geology

The bedrock that immediately underlies most of the area of southwestern Mackenzie treated in this paper is of Paleozoic or more recent age. Such granitic rocks as appear are Paleozoic or Cretaceous intrusives. The surface exposure of pre-Cambrian granite, gneiss, and metamorphosed sedimentary rocks of the Laurentian Plateau marks the eastern border of our region, and these rocks undoubtedly underlie the Paleozoic sediments in at least a part of the country east of the Mackenzie River.

Outcrops of rock occur at a few places along the Mackenzie and Liard Rivers, but the principal sources of data on the content and sequence of formations are in the Mackenzie and Franklin Mountains, where folding and faulting have brought the deeper beds to the surface, or at the escarpments of the Alberta Plateau and of the higher plateaus of the Horn and Eagle Mountains. It is unnecessary for present purposes to describe these formations in detail. Accounts of them are to be found in the reports of the Canadian Geological Survey from the time of Dawson to the present, especially in the records of surveys made between 1916 and 1923 (see discussion of exploratory history). Of greatest significance from a phytogeographic standpoint are the content and surface configuration of the beds that lie directly beneath the recent glacial or alluvial deposits. It is from these beds that much of the material in the recent deposits has come, and their topography has in large measure determined the disposition of glacial deposits and the course of modern streams.

#### *Region east of the Mackenzie Mountains*

The bedrock nearest the surface in most of the region east of the Mackenzie Mountains appears to be of Devonian shale and limestone. These are the rocks that outcrop around most of the western arm of Great Slave Lake and along the upper Mackenzie and lower Liard Rivers. They also appear in the Alberta Plateau escarpment along the Hay and Buffalo Rivers. They are generally flat-lying except in the Franklin Mountains, where they are folded and fractured. The principal variations in the surface formations, other than the Franklin Range, are three in number. On the western shore of the north arm of Great Slave Lake limestone and dolomite of Silurian age appear, but they are covered by the Devonian rocks not far from the lake shore. Higher plateaus rising above the Alberta Plateau and the Mackenzie Lowland are composed of Cretaceous sandstone and shale. The Horn and Eagle Mountains are formed of these deposits, and there is a long extension of them into the plateau of the upper Liard River west of the Mackenzie Mountains. Cretaceous beds of similar nature also appear on the banks of the Mackenzie between Norman and the Blackwater River. In the Norman area some beds of Tertiary sandstone and shale have been found overlying the Cretaceous. They have been classed as Eocene.

In all the region east of the Mackenzie Mountains, therefore, the only obstructions to the free movement of the Keewatin ice mass from east to west were the ridges of the Franklin Range and the comparatively low Cretaceous plateaus. It is to be expected that lobes of the ice were at least deflected by these uplands, and that subsequent morainic deposits should show a topographic relation to them. At the same time the surface rocks were soft enough to furnish the

glacier with a heavy load of material to be mixed with detritus from the pre-Cambrian rocks to the eastward and to be deposited as a heavy mantle of drift when the ice receded.

### *Mackenzie Mountains*

Most of the rocks exposed in the Mackenzie Mountains are sediments of Paleozoic age. The eastern and western components of the range, however, show notable differences in the composition of the beds. Along the Pelly and lower Ross Rivers, Keele described crystalline schists which are widespread in the Yukon region. They are succeeded by various beds of quartzite, argillite, slate, chert, limestone, sandstone, conglomerate, and volcanic tuff, often arranged in closely folded strata. Argillite, chert, and dark-colored limestone were also described on the upper Macmillan River by McConnell. Keele states that the mountains at the head of the Ross River "are formed of alternating beds of dark compact quartzite and grey shale and slate," and: "About ten miles east of the divide some yellowish crystalline limestones occur in low isolated cliffs along the embryo Gravel river, but the principal rocks are dark sandy shales, striped grey slates and micaceous sandstone or quartzose schists. Rocks of this character extend eastward to Mount Sekwi, about fifty miles from the divide, and then end abruptly. . . . A radically different geological province begins at Mount Sekwi, and limestones, dolomites, sandstones, and conglomerates, etc., of various bright colors, replace the sombre rocks to the westward." These are the most prominent rocks of the eastern component of the mountains, through which the Gravel and other rivers have cut their valleys. It is these strata that have been block-faulted to form the characteristic topography already described for the eastern area (PLATE II). Near the Mackenzie, Cretaceous sandstone and conglomerate are found folded into the front ranges.

The western part of the range has been intruded by masses of granite that form the cores of the higher and more rugged mountains (PLATE I). These are well described by Keele on the upper Ross, and they have been seen also on the upper Macmillan and Stewart Rivers. Farther south they form the so-called Snyder Range, west of the upper South Nahanni. Being much harder than the surrounding sediments they have weathered into serrated ridges which stand out conspicuously among the other mountain summits of the region. Keele says that the only igneous rock seen along the Gravel River, on the other hand, was a sill of diabase between beds of sandstone below the mouth of the Twitya River.

The structural history of the Mackenzie basin has been discussed by D. B. Dowling in a paper published by the Geological Survey of Canada in 1922. Dowling's conclusions were based not only upon the earlier work of Dawson, McConnell, and Keele, but he also had access to later reconnaissance in the upper Yukon region and to the extensive survey work done on the upper Mackenzie after 1916. The Mackenzie Mountains appear to have been formed by the compression and crumpling of somewhat thinner beds than those in the Rockies farther south. The crustal movement took place before the deposit of the Tertiary sediments at Norman, which are regarded on fossil evidence to be of Eocene age. Dowling states that "the northern mountains were formed early in the period of crustal compression which was inaugurated towards the close of the Cretaceous. They, therefore, antedate the outer ranges of Alberta which were formed at the close of the Eocene." The effects of these later movements can

be seen in the tilting of the Tertiary beds at Norman and in the folding of Tertiary deposits of the Wind River plateau to the west.

Dowling points out further that "the order of formation within the two groups of mountains seems to have been opposite in direction. The Rocky mountains, originating in a series of large fault blocks followed by the formation of overthrust fault blocks that formed mountain ridges to the east, show a progression from west to east. The Mackenzie mountains, with which may be grouped the Franklin mountains, originating with crustal movements followed by the regular Rocky mountain type of thrust fault blocks, show progressive development from east to west." The batholithic intrusions in the western part of the Mackenzie range are tentatively considered as Cretaceous in age. "They are intimately associated with the earlier intrusions of the coast range, but although very similar, lithologically, they were apparently intruded somewhat later . . . apparently, therefore, the country west of the Mackenzie was deformed and invaded by granite between early Cretaceous and Eocene times. The mountains between the Mackenzie and Yukon Rivers may have been outlined at this early period."

## Glacial Geology

Most of the soils and minor topographic features of southwestern Mackenzie are products of erosion and deposition during the Glacial Period, of lacustrine deposition during the retreat of the ice, or of strictly post-Glacial alluvial sedimentation. On rock outcrops, particularly in the mountains, there has been a certain amount of residual soil formation since the Glacial Period, but it is of minor importance in terms of the total surface area of the region. Most of the soils are youthful in point of time, for they originated with the final retreat of the last ice or after the withdrawal of glacially impounded lakes. They are also immature so far as the development of profiles is concerned, due in part to their youth and in part to the subarctic climate of the region. At the same time the vegetation gives every evidence of youth and immaturity in the development of community equilibria. In regions where soils have reached maturity and plant communities have reached "climax" stages, strong positive correlations between soil and vegetational boundaries cannot be expected; but where both are youthful and immature the relation of plant communities to the age and structure of soils and surfaces is apt to be a close one. The patterns of development and present distribution among the types of vegetation in our region, therefore, can be expected to show a correlation with the physiographic events of late Glacial and post-Glacial time.

In studies of vegetation in the Athabaska–Great Slave Lake region (1930, 1935, 1946), considerable evidence has been accumulated to show that such a correlation exists. It was possible to do this because sufficient knowledge of vegetational and glacial features had been gathered to draw up the principal geographic patterns involved. The field observations necessary to a similar synthesis in the upper Mackenzie country have not yet been made, though enough are at hand strongly to suggest that the correlation is possible. The operations of the Canadian Geological Survey in this area have been concerned primarily with stratigraphic problems, but nearly all of the reports contain notes on glacial features and forests. These observations, supported by some of my own, form the principal basis for the discussion which follows.

### *Glaciation east of the Mackenzie Mountains*

The great lake region of the Mackenzie was affected by glacial ice only from the east, while in the area under discussion here the Cordilleran glaciers also had a part in forming the present topography. So far as is known the eastern ice completely covered the country up to the base of the Mackenzie Mountains. It was thick enough to override most if not all of the Franklin Mountains, fill the valley of the Mackenzie between this range and the front of the Mackenzie Mountains, and to push into the lower valleys of some streams draining the latter. Keele (1910) found a gneissic boulder in the Gravel River valley 1800 feet above the Mackenzie, and Williams (1923) states that "Glacial erratics lie on the very top of Cap mountain and within 400 feet of the top of mount Clark. The boulders are Precambrian and are evidently from the east." Hume (1924) estimates that the ice in the Mount Clark area, opposite the mouth of the Gravel River, must have been at least 4300 feet thick. Deposits from this ice along the Mackenzie River have a thickness of at least 200 to 250 feet (Alcock, 1937).

It has been shown that during the retreat of the ice from southwest to northeast across the Athabaska–Great Slave Lake region a series of lobes occupied the valleys of the Athabaska, Peace, Wabiskaw, and Hay and Buffalo Rivers. These lobes were separated from one another chiefly by the Cretaceous plateau remnants known as the Birch, Caribou, and Eagle Mountains. During retreatal stages lakes were impounded in the valleys, with bottoms at levels which are now about 1600 feet, 1100 feet, 800 feet, and 700 feet above sea-level (Cameron, 1922A). Sandy outwash materials and lacustrine clays were laid down in the bottoms of the lakes, and in the most recent expansions of Athabaska and Great Slave Lakes great alluvial deposits have been formed by the Athabaska, Peace, and Slave Rivers. The topography of the ancient lake bottoms is relieved by lobate morainic systems representing temporary halts in the retreat of the ice.

In the country west of the Slave and Athabaska Rivers the most recent alluvial soils have developed a flood plain forest of white spruce whose earlier successional stages involve willows and balsam poplars. Light soils on the older and higher surfaces (800-ft., 1100-ft., 1600-ft.) have a somewhat richer forest of white spruce which appears to have developed from one of jack pine. Heavier, clayey soils on the uplands, however, show a semi-open prairie vegetation, wherein the grassland is interspersed with groves of aspen and white spruce. The largest of the prairies are on the 800-foot level, but they are also widespread on the bottom of the 1100-foot lake. Undrained depressions on all surfaces develop a typical muskeg forest of black spruce and tamarack.

It is thus evident that, whatever the actual causes, there is in this area a geographic correlation between surface age and origin on one hand and the distribution of certain types of vegetation on the other. It is of particular interest that so far as is now known the presence of semi-open prairies in this region is an indicator for the presence of glacio-lacustrine deposits of clayey soils.

Semi-open grasslands have been known for many years along the lower Liard River (Lefroy, 1857; Petitot, 1893). They have also been described northwest of Great Slave Lake along the trail between Providence and Rae, and in 1939 our party visited a prairie area on the upland west of Fort Simpson (see below for description). Grassy openings were frequently observed during our flight from Smith to Simpson. They appear on both sides of the upper Mackenzie, and

usually they can be distinguished from marsh or muskeg by their surface configuration (Raup, 1935). Further evidence for the wide extent of prairie in this regior is the fact that the wood bison formerly ranged over a large part of it —as far west as the Liard and Horn Rivers and as far north as Lac la Martre (Raup, 1933; Soper, 1941). The summer feed of the bison was in the upland prairies.

In spite of this evidence for their existence, actual descriptions of grasslands are extremely rare in the exploratory literature. This is probably due to the fact that summer travel away from the main streams has nearly all been by canoe through rivers and lakes, or in winter time over the uplands. The prairies are not usually seen immediately along the streams, while in winter, under a cover of snow, they are not easily distinguished from muskegs or marshes.

According to Cameron (1922A), a lobe of the ice lay in the upper valley of the Mackenzie during the lake stages of 1600 feet and 1100 feet. It was confined on the north by the Horn Mountain Plateau and on the south by the Eagle Mountains (Cameron Hills). Its westward extent is uncertain, but Whittaker (1923) described "sandy drumlins" along the Jean-Marie River 20–50 miles above its mouth, and another moraine about 80 miles above the mouth. One of these hills is said to be about 125 feet high. The upper moraine appears to be the dam which holds back McGill Lake. The Jean-Marie River makes an S-curve between its head and the point where it joins the Mackenzie. When the moraines are located on the map it is clear that they are not far apart and are probably portions of a single system whose trend is roughly north and south. Although Cameron makes no mention of them, they are approximately at the hypothetical margin of the glacial lobe at the 1600-foot lake stage. At the same time the lobe that occupied the Hay and Buffalo River valleys reached southwestward beyond the 60th parallel. Its terminus is marked by moraines extending across the Hay River valley between the Caribou and Eagle Mountains.

When the lake in the Hay River valley stood at about 1100 feet the upper Mackenzie lobe had retreated eastward. Cameron draws its border in such a way as to cover the Mackenzie valley to a point just below Mills Lake. He does not describe terminal moraines in this area, but notes ridges of drift on the lower Kakisa River which flows into the head of the Mackenzie from the south. These ridges apparently are tied into the very prominent moraine which more or less parallels the southwest shore of Great Slave Lake and holds back the water of Buffalo Lake. This moraine probably was formed when the Hay and Buffalo River lobe halted for the formation of the 1100-foot lake. To the southeast it connects with the Nini-sheth Hills in the northern part of the Wood Buffalo Park (Raup, 1935).

Glacial striae are in agreement with this general concept of the glacial lobes. Those in the Hay and Buffalo River valleys point in a southwesterly direction up the valleys, while those seen along the upper Mackenzie also have a strong southwesterly trend (Whittaker, 1922, 1923; Cameron, 1922B). The upper valley of Jean-Marie River, which trends in a northwesterly direction, was thought by Whittaker to have been widened and deepened by ice.

Events corresponding to those just described should be found farther north, between Simpson and Norman, but they are as yet undescribed. It is presumed that one or more lobes extended westward on the north side of the Horn Mountains, having their retreatal stages east of the Wrigley area and in the basin of Lac la Martre. Williams (1922) noted glacial grooves on Cap Mountain

near Wrigley pointing 12–17 degrees north of west, and morainic ridges approximately at right angles to this near Smith Creek on the east side of the Mackenzie a short distance south of Wrigley. On Mount Charles, north of the Bear River, Kindle recorded deep glacial grooves trending east and west (see Camsell & Malcolm, 1921). Williams (1923) saw striae on the west side of Mount Clark running west 20° north. It is not known whether this ice front in the Mackenzie valley was earlier or contemporaneous with the front placed by Cameron in the valley above Simpson.

Lacustrine sediments were reported by Whittaker (1922) along the Trout River beginning about 35 miles above the Mackenzie and extending for about 22 miles. This places them on the Alberta Plateau, and probably between the moraines which marked the 1600-foot and 1100-foot lake stages. If the existence and timing of the upper Mackenzie lobe are correctly correlated with the lobes in the Hay and Buffalo River valleys and in the Peace River valley, the Trout River lake should correspond to the one whose deposits are at about 1100 feet in the Wood Buffalo Park. Vegetational evidence noted above indicates that this or an equivalent lake was widespread along the upper Mackenzie.

Prairies northeast of Providence described by McConnell (1890) and by Russell (1898) are probably on lacustrine clays deposited during a lower lake stage. Judging by Cameron's map (1922A, p. 351) they could have been laid down in the bottom of the 800-foot lake, when the ice had vacated all of Great Slave Lake except McLeod and Christie Bays.

McConnell (1890) saw low-lying stratified sands along the Liard for a distance of some 25 miles below the mouth of the South Nahanni. He thought that they were of lacustrine origin and that they might be correlated with similar deposits seen along the Mackenzie near the mountains about 60 miles below Simpson. This suggests a post-glacial lake extending northward along the base of the Mackenzie Mountains. I can find no further discussion of such a lake by geologists who have investigated this region, and I saw no evidence of it on the flight west from Simpson. With the exception of small areas on the upland immediately west of the Mackenzie, semi-open prairies were not seen north of the Liard River between Simpson and the mountains.

The timing of the events noted above is conjectural. In a previous paper (1946) I have assembled some evidence which suggests that the morainic systems of our region represent retreatal stages of the Late Wisconsin ($W_3$) ice. It is suggested further that the last of this ice did not disappear from Great Slave Lake until comparatively recent post-Glacial time, perhaps near the beginning of the post-Glacial climatic optimum which is thought to have had its greatest development between 3000 and 9000 years ago.

### *Recent sedimentation in southwestern Mackenzie*

The surface of Great Slave Lake now stands at about 500 feet above sea-level. Immediately following the disappearance of the ice from its eastern end, however, it is thought to have been about 100 feet higher and to have been in the form of a great cross whose southern arm extended southward in the valley of what is now the Slave River to about the latitude of Fort Smith (Cameron, 1922A, p. 352). The southern arm was partly filled with lacustrine deposits, which now appear as cut banks of sand which reach their greatest height (about 125 feet) above the river at Fort Smith. The present level of Great Slave Lake

is thought to have been attained in large measure by a differential uplift which was greatest toward the eastern end and tended to "spill" the water out by way of the Mackenzie. During this period the Slave River cut its broad modern valley in the lake deposits, and began laying down the huge masses of alluvium that are gradually filling the southwestern part of Great Slave Lake.

Great Slave Lake has thus become a huge settling basin for material carried by the Slave River. A few other streams from the uplands southwest of the Lake (Hay, Buffalo) make their contributions, but the Slave brings in by far the most material. Streams entering from the north carry only small quantities of debris, for they come from areas where fine-textured rock materials are not so abundant, and where timber and other vegetation are thin. The Slave River, on the other hand, carries all the water from the Athabaska and Peace Rivers, which in turn drain most of the southern and southwestern parts of the Mackenzie basin. A large portion of the load carried by the Athabaska is left in Lake Athabaska, and at certain parts of the flood season some of that from the Peace is left there also. But most of the debris from the Peace goes on down the Slave, and on occasions of very high water in the Athabaska there is a visible procession of drift timber through the western end of Lake Athabaska and into the Slave. All of this makes up a phenomenal amount of material brought into the south side of Great Slave Lake. Kindle (1918) may well be correct in saying that "There is probably no lake in North America which receives anything like the amount of driftwood which is poured into Great Slave Lake, chiefly through the Slave River."

As a result of drainage and sedimentation, therefore, the entire southern arm of Great Slave Lake has been eliminated, with the production of thick alluvial deposits around the southwest shores. Immediately above the recent alluvial deposits are broad lacustrine plains of clay and sand. Vegetational development on the two types of terrain is sharply differentiated.

Kindle (l. c.) has pointed out the contrast between the Slave and upper Mackenzie Rivers. Very little of the material carried in by the Slave ever leaves Great Slave Lake. The water of the Mackenzie between Simpson and the lake is clear. The Slave meanders in a muddy flood plain, with banks of local silt deposits or undercut alluvium. The upper Mackenzie flows through glacial deposits of boulder clay, from which the boulders have been sorted out to form broad pavements on either side of the river. These pavements, so even in many places that they look as though they had been laid by hand, have had a tendency to act as retaining walls for the river, preventing the formation of meanders and maintaining the stream in straight courses for many miles.

Below the mouth of the Liard the Mackenzie again becomes turbid, but the Liard water remains on the west side of the Mackenzie for a long distance. According to Kindle's observations the water on the east side of the Mackenzie remains clear for about 160 miles below the mouth of the Liard.

Fort Simpson is situated on an island near the west bank of the Mackenzie just below the mouth of the Liard (PLATE II). The island is about two miles long and half a mile wide, separated from the west bank by a narrow "sny" which is nearly dry at times of low water. It appears to be covered principally by alluvium from the Liard, with the boulder clay of the region at its base. Devonian shale appears beneath the glacial deposits along the Mackenzie nearby, but none was observed at Simpson.

The village is near the upper end of the island, on a bluff about 50 feet above

the river. In cross-section the island is highest on the Mackenzie side, sloping off by a series of low steps or escarpments to the southwest. All of the lower parts of the island are marked by what appear to be old longitudinal channels formed and abandoned by the river as it cut its present course.

Further description of the Simpson area will be found in the discussion of vegetation.

### *Glaciation in the Mackenzie Mountains*

Glacial ice in the Mackenzie Mountains was thought by Keele (1910) to have been confluent with the Cordilleran ice mass of the Rocky Mountains, and to have had its gathering ground on the western slopes of the range. He estimated its thickness in the Ross River region at about 3000 feet, which would mean that it did not cover the higher peaks. He states that "the movement of the ice during its maximum development was controlled to a great extent by the main drainage valleys, and flowed down those almost, but not quite, to the Yukon River. When the ice became thick enough on the western slopes . . . it began to pour through the gaps and passes of the divide and to send streams down the valleys of the Gravel river and its branches." It is of further note that Keele thought the ice divide shifted from west to east. He found granite from the western slopes far down the eastern side of the range, and considered that during the period of shrinkage the divide shifted to the present watershed because the drift which he found in the pass between the Ross and Gravel Rivers was deposited in a zone of stagnation where there was no movement of the ice.

The exact relationship between the two glacial systems at the eastern front of the Mackenzie Mountains is yet to be worked out. Keele found Cordilleran glacial deposits overlying those from the east in the lower valley of the Gravel River, indicating that at least at one stage the eastern ice preceded the Cordilleran. One of the most striking topographic features seen from the air while flying west from Simpson is the complex system of moraines at the eastern base of the mountains. They have a well-defined lobate form, convex eastward, and were obviously formed during retreatal stages of valley glaciers. The unmodified form and continuity of their outlines indicate that they have not been disturbed by any later ice from the east. They must therefore be of the same age or younger than near-by deposits of material from the east, but whether the latter underlie them is of course unknown. The Cordilleran moraines extend a short distance away from the base of the mountains, perhaps a few miles, but what the extreme eastern limits of the ice were is yet to be determined. Striae east of the mountains are prevailingly westward in direction, but Whittaker (1922, 1923) reports two sets along the Trout and Redknife Rivers on the Alberta Plateau south of Mackenzie between Providence and Simpson. The apparently older set bear S. 50° E. and S. 45° E., respectively, suggesting a western origin for the ice in this area at at least one period.

Valley glaciation similar to that described by Keele was noted by Camsell (1906) in the Ogilvie Mountains at the head of the Wind River. He states, "All data collected with regard to the glaciation of the mountain section of the Wind river point to the conclusion, that the region was not completely covered by a great ice sheet during the glacial period; but that the valleys alone were occupied by glaciers." He proposed a glacier about 1000 feet thick flowing northward down the valley of the Wind, producing a U-shaped profile and leaving heavy deposits of gravel and clay on the valley floor. Camsell crossed the moun-

tains by way of Braine and Nash Creeks, in a pass estimated to be about 3500 feet above sea-level. He gives the elevation of the highest peaks there as about 6800 feet. He says that the region "was not covered by a large continental ice sheet, but the valleys alone were filled to a depth of 1000 to 1500 feet with valley glaciers. . . . Evidence of glaciation can be traced to a height of 4500 feet above sea level, so that about 2000 to 2500 feet of the highest peaks protruded through the ice."

## Geological Observations at Brintnell Lake

Brintnell Lake, near the head of the South Nahanni River, was, as previously stated, the scene of about two months' botanical exploration by the Arnold Arboretum expedition of 1939. Because the following discussion of the flora and its distribution involves repeated reference to this area, some observations concerning its topography and geological history are necessary.

Brintnell Lake is about 3¼ miles long and about half a mile wide at its widest point. The trend of its main axis is approximately W. 20° N., while the position of its western end is about in latitude 62° 5′ N. and longitude 127° 35′ W. Its altitude is about 2600 feet above sea-level (see *Fig. 2;* Plates I, III, IV, XI). The bottom has not yet been found, but it is evidently quite deep. Mr. Harry Snyder, who was there with a survey party in 1937, informed me that he put down about 1000 feet of cable without reaching the bottom. The lake is held to its present level by a rock barrier at the eastern end, through which the outflowing stream pours in a narrow, unnavigable gorge. This stream joins the South Nahanni about 5 miles down the valley and perhaps 800 or 1000 feet below the lake.

The mountains rise steeply from the north and south shores to heights of 6000 to 7000 feet above sea-level. About two miles west of the lake there is a higher peak that attains an elevation of approximately 8500 feet. Several streams feed the lake from the neighboring slopes, but the main intake is from a creek which flows through a great U-shaped valley to the west (Plate IV). This creek is fed by glaciers in the high mountains at the head of the valley about 7 miles above the lake. The valley floor west of the lake is made up of gravel plains and broad marshy flats of light-colored glacial clay. When our party arrived on June 16 the lake water was nearly clear, but within a few days it became "milky" from glacial melt water and remained so throughout the summer.

The mountain rocks immediately surrounding the lake are Paleozoic shales and slates. The higher peaks to the west and north, however, are composed of light-colored granites which produce jagged, serrate profiles. The contact between granites and sediments is clearly seen where it angles up the side of a mountain just west of the lake (Plate III). The presence of granite peaks in the upper South Nahanni country was not known until quite recently. In terms of Keele's division of the Mackenzie range into eastern and western phases, this region should be placed with the western section, where intrusive granites form the cores of the higher mountains.

The slates and shales dip sharply to the southwest, forming high cliffs and talus slopes on the north sides of the mountains (Plate X). The south-facing slopes are somewhat less steep, but due to the sharp angle of the strata nearly all of the slopes are precipitous. The valley that contains the lake, therefore, is similar to the fault block valleys described by Keele along the Gravel River, and it shows a similar orientation of dip and strike.

The contrast between the topography and soils of the shale and granite areas is striking. A small stream, Frost Creek, entering the north side of the lake near the western end, issues from a hanging valley in the shale mountains (PLATE III). The lower end, or rather the rim, of this valley is about 1400 feet above the lake. From various points in the valley and on its lateral slopes there are good views of the higher topography formed from this kind of rock. In spite of the steep dip of the strata, many of the upper slopes have become

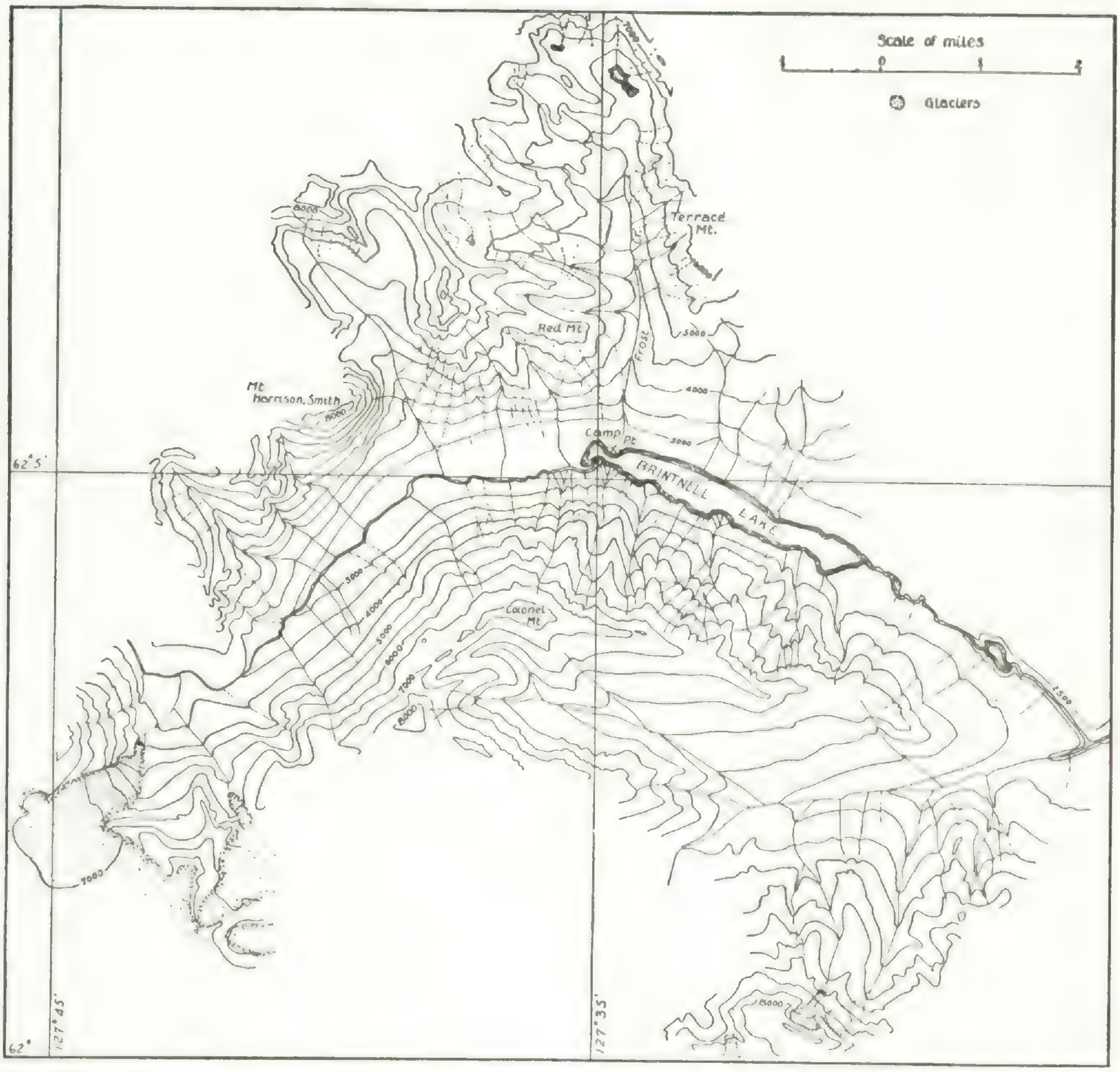


FIG. 2. Map of Brintnell Lake and vicinity, redrawn from a manuscript map made by Mr. Fred Lambart in 1937.

rounded and have produced through weathering a fair amount of soil (PLATE X). Below the summits, however, there are large areas of slide rock, much of which is still in motion, forming great "rivers" of rock down the slopes and in the higher gullies. The degree of stability in this slide rock determines, and is in turn conditioned by, the amount of vegetation growing on it. North slopes are of course cliff-like and at the higher elevations are almost completely devoid of vegetation. The talus here is so active that plants can hardly get a footing. By contrast the country a little farther west, where the granite peaks rise out

of the shales, shows very little soil produced in situ. The granite cores are exfoliating in enormous blocks and slabs to form ponderous and almost sterile talus slopes. The granite peaks show almost no green plant life.

The break-up of the mountain rocks and the formation of talus is going on continuously and rapidly. While we were camped at the lake we frequently heard the rumbling sound of landslides, and occasionally we saw clouds of dust rising from the high slopes or caught sight of huge blocks of stone as they tumbled off the cliffs and bounced to a standstill on the talus. Conspicuous features of the lake shores are points formed by steep fans of rock debris (PLATE IV). These are most highly developed on the south shore at the foot of the precipitous north slope of Colonel Mountain.

The shales contain many stringers of calcite. These are most abundant on the mountain south of the lake, a fact which appears to be reflected in the vegetation, for there seem to be more calcicolous plants there than on Red and Terrace Mountains on the north side.

The glacier at the head of the main stream is obviously the remnant of a larger one which once flowed down the lake valley. The U-shaped form of the valley, with its sharply truncated transverse ridges, is clear evidence of this (PLATE IV). The truncated slopes have a gradient of about 34 degrees from the horizontal and descend into the lake with scarcely any shore formation (PLATE IV). All of the fans mentioned above postdate the retreat of the ice.

Glacial deposits were found up to an altitude of approximately 4000 feet in the main valley and 5000 feet in the valley of Frost Creek. In the main valley they are of two kinds. On the south-facing slopes north of the lake are ridges of gravel and boulder clay festooned diagonally down the steep slopes in a southeasterly direction. The channels of streams cutting through the ridges are filled with boulders from the till. These deposits are rather loose and uncompacted, with little or no evidence of cementing. On the opposite side of the lake, masses of till were found packed into the great gullies on the north slope of Colonel Mountain, indicating that the gullies and intervening hogbacks were formed before the last advance of the glacier. Presumably the till completely filled the gullies to a height of about 4000 feet, at which level the remains of it form shoulders on the truncated fronts of the hogbacks (PLATE IV). The fact that these shoulders have truncated surfaces which are confluent with those of the underlying rocks of the hogbacks indicates that this till antedates the last advance of the ice and must have been deposited during an older advance and retreat.

In some places tributary gullies have been formed on the lateral slopes of the hogbacks in such a way as to excavate the back sides of the old till deposits. In one such place a section of the till about 200 feet thick was examined (PLATE V). The lower part is of fine sandy or clayey material interspersed with beds of coarser gravels. Above this comes a bed of unsorted till containing coarse material, and then the whole section is capped by a mass of heavy boulders set in a matrix of finer materials. The entire section shows a large amount of compacting and cementing, some of it almost resembling tillite. It is breaking up in great columnar blocks which are often capped by large boulders that give them a castellated appearance.

These two tills differ not only in age, position, and degree of cementation, but also in the composition of their included rocks. Gravel and boulders washed out of the younger deposits are mostly of granite and shale, while in the old

compacted till there are massive blocks of conglomerate, cherty stones, and blocks of what appear to be a reddish quartzite.

North of the lake, in the hanging valley mentioned above, are tills which form terraces on the valley slopes. The highest of these terraces is at about 5000 feet, near the rim of the valley, and is composed of unsorted drift in which the boulders are principally of granite (PLATES III, VI). Large erratic boulders are frequent on the surface. There are at least two sets of the terraces, representing two periods of stream dissection through the drift. The lower is of very loose gravelly till, also made up principally of granite stones.

There is therefore unmistakable evidence of two advances and retreats of a glacier in the main lake valley, with possible reflections of both of them in the terraces of the hanging valley. The character of the rocks in the older till of the main valley suggests that they came from the western slopes of the Mackenzie range. If this is true it is consistent with Keele's findings in the Ross and Gravel River region. Also the prevalence of granites in the younger tills suggests that the center of spread for the main ice mass may have shifted eastward, as Keele thought it did. The absence of western rocks in the drift of the hanging valley might well be due to its local origin as a tributary glacier among the granite mountains immediately north of the lake.

On the rock barrier at the eastern end of the lake are some gravelly and sandy ridges that look like outward deposits formed during the recession of the ice. Similar deposits form gravel plains on the valley floor west of the lake.

The influence of frost upon the formation and movement of soils is everywhere to be seen. Well-defined stone rings were found in a springy area on the till in the upper valley of Frost Creek (PLATE VI). The rings range in diameter from a few inches to six feet or more. Many of the upper mountain slopes are literally covered with turf-banked terraces in varying stages of stabilization (PLATE IX). The rounded contours of many of the higher slopes on the shale mountains appear to be due to long-continued soil formation and solifluction caused by frost (PLATE X). In these higher altitudes frost action presumably has been continuous throughout the Glacial Period, as it is very probable that summits above 5000 feet were not covered by glaciers. Similar topography is to be seen on many mountains in the South Nahanni country (PLATE II), as well as along the Canol Road (see above).

## SUMMARY OF TOPOGRAPHIC AND GEOLOGIC OBSERVATIONS

From a phytogeographic standpoint, the following topographic and geologic features of southwestern Mackenzie are of outstanding interest. Most of the soils, though immature, are deep and derived in large measure from relatively soft rocks. The principal exceptions to this are on the higher slopes of the mountains and in areas near the margin of the Laurentian Plateau. The presence of beds of limestone and calcareous seams in the slate has made possible the growth of calcicolous plants throughout most of the region. The oldest land surfaces are on the unglaciated higher slopes of the Mackenzie Mountains. Next in age are the tops of the Horn and Eagle Mountains which separated the retreating lobes of the Keewatin ice sheet. The retreat of the Cordilleran and Keewatin ice opened next the Alberta Plateau and the Mackenzie Lowland, as well as the lower valleys of the Mountains. There appears to be a sequence

in age on the surfaces east of the mountains, progressively younger from west to east; so that the most recently exposed lands are old lake bottoms immediately surrounding Great Slave Lake and newly formed flood plain and delta deposits on the shores of the lake itself. In the mountains the most youthful surfaces are near the heads of the interior valleys, where considerable areas have been uncovered by the recent retreat of the glaciers.

The Mackenzie Mountains have certain features that are of primary significance to the plant geographer. First, they are sufficiently high so that their summits and upper slopes are far above timber line, making possible the development of an arctic alpine tundra vegetation. Second, they are isolated from neighboring ranges by comparatively low, timber-covered plateaus and lowlands, so that their alpine areas are not connected with those on the neighboring ranges or with the arctic tundra. Third, they have a great variety of rocks, among which there is a demarkation between eastern and western groups (just east of the divide in the latitude of the upper Gravel River). East of this boundary massive limestone, dolomite, and shale are very prominent, while west of it quartzite, argillite, cherty rock, and sandstone are present in profusion along with limestone. Furthermore the western group is intruded by great masses of batholithic granite. Calcicolous floras can be expected therefore to develop more extensively over the limestone of the eastern section, while at the same time a greater instability of soils can be expected there due to the ease with which limestone and shale are broken up by frost action. Botanical effects of the difference in rock types are not simple, however, for, as Keele has pointed out so clearly, the climatic and topographic differences between the east and west slopes of the range are sharp and striking. The west slopes receive heavy precipitation, which is carried off in broad, more nearly graded valleys, while the eastern slopes have comparatively light rain- and snowfall and the valleys are steep and canyon-like.

## CLIMATE AND AGRICULTURE

The difficulties involved in a phytogeographically significant description of the climate of southwestern Mackenzie are well-nigh insurmountable with our present knowledge. It is presumed that when data gathered during the war are released the situation will be much improved, but until that time we must be content with the scanty records and interpretations now available.

In previous papers (1934, 1935, 1946) I have already discussed the climatic phenomena of the Peace River region and of the Athabaska–Great Slave Lake district. So far as is known, that of the upper Mackenzie valley is not far different from that of the northern part of the Wood Buffalo Park and the western Great Slave Lake country. Consequently there is no need for a repetition of the discussion here. I shall limit this treatment, therefore, to a brief and general characterization of the climate of the region of Fort Simpson; and I shall attempt to draw up some contrasts between the climate of Simpson and that of the Brintnell Lake district in the Mackenzie Mountains. On the occasion of our 1939 expedition we kept records of maximum and minimum temperatures at Brintnell Lake, and notes on local weather. These can be compared profitably with simultaneous records made at the government weather station in Simpson, and with the daily weather maps for the same period.

## Climate at Simpson

I have included in Table 1 equivalent measurements for Fort Norman and Fort Smith, chiefly in order to relate the Simpson area to its surroundings and to my earlier discussions for the Athabaska–Great Slave Lake country.

It will be seen at once that there is a close similarity in the climatic features of the upper Mackenzie valley and the Slave River country. The climate as a whole is continental in character, with short, relatively warm summers and long cold winters. Even though high temperatures are sometimes reached at Simpson (the highest recorded is 94° F.), the growing season is short and hazardous. July minima of 31° have been recorded at the weather station, so that a completely frostless season cannot always be depended upon. There is an *average* season free of frost, however, of between 70 and 75 days. Between 40 and 50 percent of the annual precipitation falls in the months of May to August, inclusive, and the mean annual snowfall is between 40 and 60 inches. The wettest month at Smith and Simpson is July, but farther north, at Norman, it is August.

TABLE1.[1]

Summary of meteorological data from Forts Smith, Simpson, and Norman

| | Total annual precip. | Total rainfall | Rainfall June, July, Aug. | Mean temperature | | Mean daily range | |
|---|---|---|---|---|---|---|---|
| | | | | Jan. | July | Jan. | July |
| Fort Smith 1913–1934 | 12.67 | 8.55 | 4.05 | −15.1 | 59.9 | 16.1 | 26.7 |
| Fort Simpson 1897–1927 | 13.45 | 7.67 | 4.77 | −19.2 | 61.6 | 16.4 | 23.3 |
| Fort Norman 1908–1928 | 10.70 | 7.02 | 5.05 | −18.6 | 59.2 | 14.6 | 24.5 |

[1] Data extracted from publications by Connor (1937, 1938).

An outstanding feature of the climate from a botanical standpoint is the low yearly precipitation. This is especially notable when the three months of the most active growing season are considered (June, July, and August). Such low precipitation in a southern climate would be a concomitant of desert conditions, but in the Mackenzie region there is no apparent lack of available moisture in the soil. It is presumed that the source of this moisture is in the permanently frozen subsoil, and that the availability of the mositure is dependent upon summer temperatures sufficiently high to release it. Climatic values that might be critical in the delimitation of vegetation, therefore, probably should be looked for in temperature rather than in precipitation.

## Seasonal Phenomena and Agriculture at Simpson

Detailed consecutive observations of seasonal phenomena are not available for most of the Mackenzie settlements, although a few outstanding events such as the opening and closing of navigation have been recorded faithfully. We are dependent upon random notes made by various travelers for piecing together the

progression of changes that occurs during the year. The principal sources of published information for the vicinity of Simpson are in papers by McConnell (1891), Preble (1908), Kindle (1920), and Albright (1933A, 1937). These will be drawn upon freely in the following notes.

Warm weather begins in spring during late April or early May. In 1888 McConnell reported that the temperature rose above freezing for the first time on April 20, and after May 1 the snow rapidly disappeared. Preble states that in 1904 the spring was somewhat earlier. In that year the average daily maximum temperatures rose above freezing during the first week of April, but the average daily minima did not rise above 32° until the fourth week. They again fell below it in the first week of May, and rose above it for the season in the second week of May.

Preble noted that the buds and catkins of willows and alders "imparted a brown tinge to the hillsides" on March 30. The snow had nearly disappeared from the open fields by April 18, and the sap of the white birches began to flow freely on April 20. Mosquitoes also first appeared on April 20. A little snow fell on May 6, and the leaves of *Ribes oxyacanthoides* began to appear May 8. Leaves of aspens and white birches were half an inch in length on May 14, and violets bloomed at about the same time. *Viburnum edule* and *Populus Tacamahacca* were in leaf by May 18, and *Vaccinium Vitis-Idaea* was in flower. *Ribes oxyacanthoides* and *Calypso bulbosa* were in flower on May 22. There were several inches of snow again on May 29. The leaves of the larch were first seen on June 2 a few miles below Simpson.

The ice in the Liard river breaks up in spring before that of the Mackenzie. In 1904 this occurred on April 29. The Liard ice drove a channel across the Mackenzie and piled up high on the north bank. The breakup of the Mackenzie ice below the Liard did not occur until May 2. According to Kindle this was a little earlier than usual, for he states that the average dates of opening at Simpson are between May 10 and 15.

The Mackenzie ice does not open between Great Slave Lake and Simpson until two and a half or three weeks after the ice has gone out below the latter place. Great Slave Lake itself usually opens between June 16 and July 2.

In the autumn the larger bays of Great Slave Lake become covered with ice in October, early or late, depending upon the season. In the wider parts of the lake the water may remain open until mid-November. The upper Mackenzie usually closes in the latter half of November, though it is sometimes closed to canoe navigation in mid-October. In terms of vegetation growth, the season ends during the latter half of August or early in September. Most of the native flora has set its fruit by the last week in August.

At the time of our arrival in Simpson on June 8, 1939, the spring was far advanced. About fifty species of plants were found in flower there during the week between June 9 and June 16. We experienced the first frost at Simpson on August 24, soon after our return there from Brintnell Lake. Plant collecting continued to be profitable until about mid-September, though most of the vascular flora had already matured and lost its seed. The first killing frost has sometimes been reported quite late. Albright states that it did not occur in 1930 until September 24, and Kindle recorded the first notable freeze in 1920 on September 25. Kindle noted two to three inches of snow at Providence on October 1.

Successful gardens have been grown at Simpson for many years. Root crops, such as potatoes, carrots, and rutabagas, are particularly successful, and some oats

and barley are raised. Squaw corn will not mature, but will produce roasting ears. Vegetable marrow is raised from seed, and tomatoes will occasionally ripen out of doors. Most tomatoes are taken in to ripen, however, for it is estimated that they will ripen on the vine in only about two years in ten.

Approximately fifty acres are under cultivation, mostly on the island, but in part on a low flood plain on the west bank of the river. No cultivation has been attempted except on the alluvial soils along the main river. Domestic livestock is wintered successfully, supplementing the feed with wild hay cut in the neighborhood. Some of this hay comes from the semi-open prairies on the upland west of the river. Of crops raised in excess of local needs, potatoes and rutabagas are most important. They are shipped down the river to missions where gardening is not so profitable.

## Comparison of the Climates of Simpson and Brintnell Lake

Our party spent 61 days at Brintnell Lake between June 16 and August 20. During this period 60 maximum and minimum temperatures were recorded with a Sixes type thermometer placed in a protected situation on the shore of the lake about four feet above the ground. The altitude of Simpson is approximately 420 feet above sea-level, and that of the lake about 2600 feet. Table 2 summarizes the observations taken at the lake, and offers a comparison with those derived from meteorological records at Simpson for the same period of days. Temperatures are in °F. and precipitation in inches.

TABLE 2.

Summary of meteorological observations at Simpson and Brintnell Lake, June 16–August 20, 1939

| | Simpson | Brintnell L. |
|---|---|---|
| Average maximum temperature | 72.8 | 65.7 |
| Absolute maximum temperature | 84.0 | 83.5 |
| Average minimum temperature | 48.6 | 43.6 |
| Absolute minimum temperature | 36.0 | 32.0 |
| Maxima | | |
| No. of days 80° or above | 11 | 1 |
| No. of days 72° or above | 37 | 13 |
| No. of days 65° or below | 9 | 25 |
| No. of days 60° or below | 4 | 13 |
| Minima | | |
| No. of days 50° or below | 39 | 55 |
| No. of days 40° or below | 2 | 15 |
| No. of days 32° or below | 0 | 1 |
| No. of days on which Brintnell L. maxima were higher than those at Simpson (56 days compared) | 10 | |
| No. of days on which Brintnell L. minima were higher than those at Simpson | 8 | |
| No. of days on which rain fell | 19 | 29 |
| No. of clear or partly cloudy days | 54 | 41 |

The mean and absolute maximum or minimum temperatures do not contrast the two places so well as the distribution of the maxima and minima. It is about 6 degrees colder at the lake as shown by the averages, but from the standpoint of growing conditions it is more significant that the maxima rose to 72° or above on nearly 3 times as many days at Simpson as they did at Brintnell Lake, and

that they remained at or below 65° on 25 days (about 42% of the total) at the lake as against 9 days at Simpson. Likewise it is notable that the minima fell below 50° on 55 nights at the lake, and below 40° on 15 nights, against 39 and 2 nights, respectively, at Simpson. Reversals of the usually lower temperatures in the mountains were noted on 10 days for maxima and 8 nights for minima. The daily ranges of temperature do not differ greatly. At Simpson the greatest was 37° and the least 6° (mean 24.6°), while the greatest at the lake was 36° and the least 4° (mean 22°).

Periods of storminess were somewhat more numerous at the lake. The accompanying chart (*Fig. 3*) shows the approximate dates of the stormy periods.

Although no rainfall measurements were made at the lake, the amount for the 60 days can safely be estimated as at least two or three times as great as that at Simpson. In the same period only 1.29 inches were recorded at the latter place. On 19 of the days for which rain was recorded at the lake it was noted as light rain or mist, but on the other 10 days there were heavy downpours lasting from one to several hours.

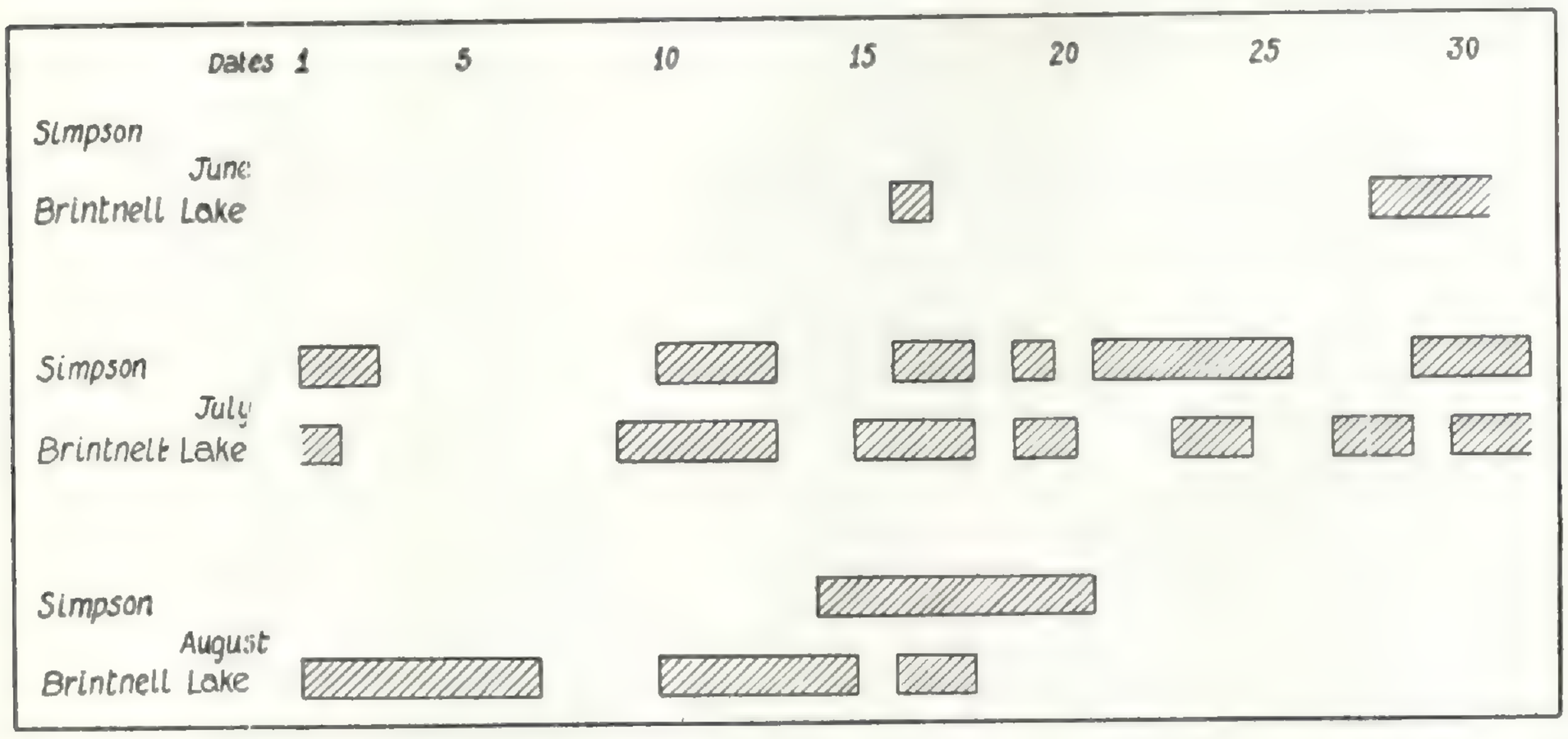


FIG. 3. Chart showing a comparison of periods of storminess at Simpson and Brintnell Lake between June 16 and August 20, 1939.

It will be noted that in the stormy periods of June and most of July there were coincidences between the two areas, but in August the correlation is not so clear. Examination of the daily weather maps for the period in question shows a relationship between the occurrence of storminess in the Brintnell Lake–Simpson region on the one hand and the appearance of pronounced high pressure systems moving in from the Pacific over southeastern Alaska and northern British Columbia, in contact with low pressures moving eastward and southeastward over central Alaska and Yukon. These lows appear to follow two courses. They may come over the lower Mackenzie, apparently moving eastward around the northern part of the Mackenzie Mountain mass, and thence southeastward up the Mackenzie valley. Or they may move eastward over the upper Yukon and upper Liard valleys, reaching the upper Mackenzie region by way of the Liard gap. The stormy periods that appeared at Simpson and Brintnell Lake at about the same time appear to be most closely related to the former of these two storm tracks, although the latter sometimes affects Simpson also. It will be noted that

in four of the periods the Brintnell Lake region was affected a day or two earlier than Simpson.

The storm of July 21–25 at Simpson seems to have been at the contact between a pronounced low over Keewatin and a pronounced high coming in from the north Pacific. This complex did not affect the Brintnell Lake area until the 23rd, when a low appeared from central Yukon, approaching on the west side of the Mackenzie Mountains.

## PLANT COMMUNITIES OF SOUTHWESTERN MACKENZIE

### Introductory

It has already been made clear that the botanical exploration of southwestern Mackenzie is scarcely more than begun. This applies not only to purely floristic aspects, but also to knowledge of vegetational structure. Descriptions of plant communities drawn in anything approaching detail have been made in only three areas: Fort Simpson, Brintnell Lake, and the vicinity of the Canol Road between Norman Wells and Macmillan Pass. A fourth point of departure is to be found in my earlier studies (1935, 1946) on the Athabaska–Great Slave Lake region, which overlaps the southeastern part of the area now under consideration.

The vegetation east of the mountains is considerably better known than that in the mountains themselves. From notes made at Simpson, along the upper Mackenzie, and in the Wood Buffalo Park, together with casual observations made by various travelers in the past, it is possible to form a fair picture of the types of vegetation in this area. There are, however, large lacunae to be explored, especially on the outlying Cretaceous Plateaus (the Horn and Eagle Mountains) and on the Franklin Range. Likewise the semi-open prairies along the Mackenzie and lower Liard and north of Providence remain to be studied. Our examination of the grassland openings on the upland west of Simpson hardly does more than point to this problem. For the Mackenzie Mountains it is impossible to do more than describe the isolated areas that have been seen and discuss the affinities of their flora, with full appreciation of the fact that only a beginning has been made.

In the ensuing discussions I shall divide the region as suggested above, first putting together what is known of plant communities outside the Mackenzie Mountains, and then proceeding to an account of those at Brintnell Lake. Communities along the Canol Road have already been published upon (Porsild, 1945), and will be mentioned only in outline or by way of comparison with the Brintnell Lake area.

### Plant Communities in the Vicinity of Fort Simpson

Notes on the vegetation around Fort Simpson were made during the second week of June and over a period of about three weeks in late August and early September, 1939. The following descriptions of communities are formed from these notes and from collections made by our party in the same intervals (see Plate II). They are therefore somewhat incomplete due to the limited time available, and also because of their seasonal restrictions.

For purposes of discussion the following plant communities or groups of communities can be defined for this area: Flood plain white spruce forest; upland forest of white spruce, jack pine, aspen and poplar; prairies; river sand bar

and river bluff associations; and old fields. A few local muskegs occur in the vicinity, but they are of small extent and not different from muskegs described elsewhere in the central Mackenzie basin.

### *Flood Plain Spruce Forests*

As noted earlier in this paper, Fort Simpson is on a small island in the Mackenzie River just below the mouth of the Liard. It is nearest the southwest bank of the Mackenzie and is connected to the latter at stages of low water by sand and mud bars. The whole island is part of a low flood plain, portions of which also appear on the adjacent main river bank. The plain is quite limited, however, and lies at the foot of a high bluff which here borders the modern valley of the river (PLATE II). The island is composed largely of silt, most of which appears to have come from the Liard River. It is highest on the northeast shore, where an eroding bluff descends to the river. From the top of this bluff the surface drops off by a series of low terraces to the sand bars above mentioned. In the lower areas there are many old channels, some of which still contain sloughs. The channels are roughly parallel to the river and to the long axis of the island.

It is probable that the entire island and other parts of the flood plain were covered with forest prior to the founding of the settlement during the first decade of the 19th century. Extensive clearings have been made for pasture and cultivation both on the island and on the adjacent mainland, but remnants of the forest are still abundant.

PRIMARY SPP.: *Picea glauca* var. *albertiana, Viburnum edule, Rosa acicularis,* woodland mosses.

SECONDARY SPP.: *Equisetum pratense, Equisetum scirpoides, Carex bonanzensis, Carex media, Calypso bulbosa, Habenaria obtusata, Populus Tacamahacca, Salix arbusculoides, Salix Bebbiana, Alnus tenuifolia, Betula papyrifera* var. *humilis, Geocaulon lividum, Mitella nuda, Ribes hudsonianum, Ribes lacustre, Ribes oxyacanthoides, Fragaria vesca* var. *americana, Rubus acaulis, Rubus pubescens, Viola renifolia* var. *Brainerdii, Shepherdia canadensis, Cornus canadensis, Cornus stolonifera, Pyrola grandiflora* var. *canadensis, Castilleja Raupii, Boschniakia rossica, Lonicera glaucescens.*

Like most of the flood plain forests in our region, it is difficult to describe this community except in terms of developmental stages which are now clearly to be seen on the sand bars. Whether the older forest at higher levels on the island had the same origin is of course conjectural, because we have no data on the age of the deposits or on their relation to the advent of forests in the region. At present the successional stages are nearly identical with many that I have described (1935) along the lower Peace and Slave Rivers. A forest of balsam poplars precedes the spruce, and this is in turn preceded by willows and alders (see below). Intermediate stages are common. At Simpson the whole sequence can be seen simply by walking across the island, where the mature spruce forest is on the older, higher terraces, while the stages are progressively younger toward the sand bars of the back channel or "sny." In the poplar woods alders and willows are the primary shrubs, and mosses have only begun to cover the ground. Young white spruces come up under the poplars and gradually replace them.

### *Upland forests of white spruce and jack pine*

Detailed notes on the upland forests west of the river opposite Fort Simpson could not be made, but the following will be sufficient to characterize them.

They are composed principally of *Picea glauca* vars. *albertiana* and *Porsildii*, *Pinus Banksiana*, *Populus tremuloides*, and occasional mixtures of *Populus Tacamahacca*. The commonest shrubs are *Rosa acicularis*, *Salix Bebbiana*, and *Viburnum edule*. *Arctostaphylos Uva-ursi* is abundant, as are also *Carex siccata*, *Bromus Pumpellianus*, *Aster Lindleyanus*, and *Hieracium canadense*.

Except for scattered muskegs the surface of the upland is sandy and well-drained, with low sand ridges here and there. The pine forms nearly pure stands on these sandy hills. Evidence of fire is everywhere to be seen, and the present composition of the forest is no doubt conditioned by burning. In fact it strongly resembles a fire-induced type that is seen on most of the uplands of the central Mackenzie basin (Raup, 1935, 1946). If this is the case the primary forest on the upland is probably of white spruce. Fires of varying intensity and over soils of varying dryness have given rise to every possible mixture of spruce with aspen, poplar, and pine, or to nearly pure stands of pine. Every indication is that the spruce is finally rehabilitated if left undisturbed for perhaps 75 to 100 years.

### *Prairies*

An outstanding feature of the vegetation in the Simpson area is the occurrence of small prairie openings in the upland forest west of the river (PLATES II, XI). Some of the openings have been utilized by the people of the trading post as a source of wild hay, and stock has sometimes been pastured in them. They vary in size from patches only a few yards across to expanses of 30 acres or more. The soils are rather loose and sandy in texture, but very dark brown in color. The surfaces usually have little or no "saucer-form," though some of the openings have shallow wet depressions or stream channels in them.

The most widely spread community found in the prairies is as follows:

PRIMARY SPP.: *Calamagrostis neglecta*, *Poa pratensis*, *Juncus Vaseyi* (alternating).
SECONDARY SPP.: *Botrychium multifidum*, *Agrostis scabra*, *Poa palustris*, *Carex Bebbii*, *Salix Bebbiana*, *Arabis hirsuta* var. *pycnocarpa*, *Geum macrophyllum* var. *perincisum*, *Rosa acicularis*, *Rubus strigosus*, *Astragalus frigidus* var. *americanus*, *Vicia americana*, *Epilobium angustifolium*, *Arctostaphylos Uva-ursi*, *Stachys palustris* var. *pilosa*, *Galium boreale*, *Solidago decumbens* var. *orcophila*, *Aster Lindleyanus*, *Antennaria nitida*.

This community makes a thick turf in which the *Calamagrostis* is easily the most abundant species, though in a few places it is superseded by *Poa pratensis* or *Juncus Vaseyi*. Its principal variations are a dry phase, in which *Arctostaphylos* is abundant and *Equisetum prealtum* becomes very common, and a wet meadow phase. The wet meadow is not uniform, but is composed of patches of nearly pure stands of *Carex rostrata* or of dense mats of *Carex aurea*. Other characteristic species of the wetter ground are *Deschampsia cespitosa*, *Phalaris arundinacea*, *Carex leptalea*, *Habenaria hyperborea*, *Polygonum natans* f. *Hartwrightii*, *Ranunculus Macounii*, *Potentilla norvegica*, *Mentha canadensis* var. *glabrata*, and *Galium trifidum*.

The margins of the prairies are apparently being invaded by the neighboring woods, though the rate at which this is occurring could not be estimated. Young jack pines, aspens, and balsam poplars are pushing in from the borders, the aspens most vigorously.

These prairies have all the outward aspects of those in the Wood Buffalo Park (Raup, 1935). Superficial examination suggests that they occur on more

porous soils, however, than most of the Park openings. Also their flora is much smaller, and their primary species are somewhat different. *Poa pratensis* prairies were seen at the eastern base of the Caribou Mountains, but *Calamagrostis neglecta* was not found there. This may be due in part to seasonal aspects. *Juncus Vaseyi* is common enough in the Park area, but I have not seen it occupying any other than a secondary position in the communities there.

There is no evidence that the prairies are not "natural." Continued grazing and repeated burning can sometimes cause grassy openings in a forested country (Raup, 1945) ; but those I have seen were obviously related to long-established Indian camp sites, none of which were seen in this neighborhood. Neither were there any old stumps or disturbances of the soil surface due to the wind throw of trees.

There are no doubt other prairie areas in the vicinity which would throw further light upon the composition and possibly upon the history of this type of vegetation. Openings north of Providence have long been known, and prairie-like vegetation has been seen by travelers south of the Mackenzie and west of Great Slave Lake. Until further observations have been made in this little-known regior it is futile to attempt any generalizations with regard to the flora and community structure of the grasslands.

### *Plants of sand bars and river banks*

From a phytogeographic standpoint the river banks and sand bars at Simpson hold perhaps the most interesting part of the local flora. This is due not only to the variety and geographic affinities of the plants, but also to the fact that these situations contain some of the developmental stages leading to the flood plain forests.

All of the shores present unstable and hazardous habitats for plants. All but the higher parts of the bluffs are subject to flooding in spring, while at lower levels there is a progressively shorter growing season determined by the gradual ebb of the river during the summer. All the surfaces are subject to erosion by the river, either in the season of high water or at the time of ice flow in the spring. Late in the season the higher sand bars dry out and are subject to wind erosion, even forming into small dunes. To withstand these rigors plants must, in addition to withstanding the subarctic climate, be perennials with root or rhizome systems of great flexibility, or annuals whose disseminules are extremely hardy.

The plant associations here are nearly all open. The individual plants are often widely scattered, with most of the ground surface unoccupied. It is impossible to designate well-defined communities except on the older sand bars, although certain species are more abundant than others in specific habitats. A general list of species noted on the sand bars is as follows:

*Equisetum arvense, Equisetum fluviatile, Agropyron latiglume* var. *pilosiglume, Agropyron trachycaulum* var. *typicum, Beckmannia Syzigachne, Cinna latifolia, Deschampsia cespitosa, Eleocharis palustris, Juncus alpinus* var. *rariflorus, Juncus balticus, Juncus nodosus, Salix interior* var. *pedicellata, Salix lasiandra* var. *recomponens, Salix mackenzieana, Polygonum aviculare, Polygonum lapathifolium* var. *salicifolium, Rumex maritimus* var. *fueginus, Corispermum hyssopifolium, Rosa Woodsii, Astragalus yukonis, Hedysarum alpinum* var. *americanum, Sium suave, Plantago major, Solidago lepida* var. *elongata, Aster falcatus, Aster junceus, Aster sibiricus, Erigeron philadelphicus, Artemisia biennis, Artemisia Tilesii.*

Damp sand at the borders of lagoons and sluggish channels has conspicuous stands of *Juncus nodosus, Juncus alpinus* var., *Juncus balticus,* and *Equisetum arvense. Rumex maritimus* var. *fueginus, Beckmannia Syzigachne, Polygonum lapathifolium* var. *salicifolium,* and *Sium suave* also appear to reach greatest abundance in these wetter areas.

The higher sand ridges and terraces are either colonized directly by willows, *Salix interior* var. *pedicellata,* or have an intermediate association composed principally of *Equisetum fluviatile* with a mixture of *Eleocharis palustris.* The legumes, asters, and roses are found chiefly among the willows. Of the latter the sand bar willow, *Salix interior* var., is the pioneer species. On older bars it has an admixture of *Salix mackenzieana* and *Salix lasiandra* var. It is in these willow thickets that *Populus Tacamahacca* and *Alnus tenuifolia* first appear as forerunners of the flood plain forests.

The most abundant species on windblown sand is *Corispermum hyssopifolium.* In many places it is the only plant that inhabits this unstable habitat.

In an earlier part of the paper I have already described one of the more remarkable physiographic features of the upper Mackenzie—the boulder pavements which form the banks of the river for many miles. The rocks are of varying size, from cobblestones to huge boulders, most of them with glacial facets, but all much rounded and waterworn. They lie in a scanty matrix of sand and silt which is usually damp at lower levels but may become quite dry in late summer. As in the vegetation of the sand bars, plants are scattered loosely, usually without semblance of arrangement into communities. In any one locality the number of species is exceedingly small, but when taken together from a mile or so of riverbank they show a surprising variety.

*Triglochin palustre, Agropyron trachycaulum* var. *typicum, Calamagrostis inexpansa* var. *brevior, Deschampsia cespitosa, Poa glauca, Eleocharis palustris, Juncus balticus, Juncus nodosus, Allium Schoenoprasum* var. *sibiricum, Sisyrinchium angustifolium, Salix glauca, Rumex maritimus* var. *fueginus, Chenopodium album, Corydalis aurea, Rosa Woodsii, Astragalus alpinus, Astragalus tenellus, Astragalus yukonis, Hedysarum Mackenzii, Linum Lewisii, Epilobium glandulosum* var. *adenocaulon, Apocynum sibiricum, Mentha canadensis* var. *glabrata, Stachys palustris* var. *pilosa, Rhinanthus groenlandicus, Veronica peregrina* var. *xalapensis, Solidago graminifolia* var. *major, Solidago lepida* var. *elongata, Aster angustus, Aster falcatus, Aster junceus, Helenium autumnale, Achillea Millefolium, Achillea sibirica.*

This assemblage resembles somewhat that of the sand bars, but many of its plants are drawn from more mesophytic habitats. The prevalence of heavy boulders undoubtedly renders it far more reliable as a plant habitat than the open sand. The above list can only be a partial one, for it is based upon one set of observations in a limited area. Further looking along the river banks would no doubt greatly increase it.

Steep river bluffs, composed of till, loose shale, or undercut banks of silt, have an exceedingly scanty flora in the neighborhood of Simpson. A few plants, however, were found only in these places: *Braya humilis, Astragalus aboriginum, Elaeagnus commutata, Crepis elegans.* The only willow noted on the bluffs was *Salix arbusculoides. Acer negundo* is growing on the steep bank of the river at the village of Simpson, probably planted there by the early traders.

### *Plants of fields and clearings*

An attempt was made to record the species growing as "weeds" in and around Simpson. There are several pastures and cultivated areas in the vicinity, in

various conditions of tendance, and many of the roadways and dooryards are grazed and fertilized by horses and cattle. A great variety of garden vegetables and flowers have been grown or attempted through the years, so that there have been abundant opportunities for the advent of weeds and escapes. Stock feed brought down by boat has added to these sources. The following species were noted in clearings and old fields:

*Hierochloë odorata, Hordeum jubatum, Poa glauca, Poa pratensis, Carex aenea, Carex praticola, Juncus bufonius, Sisyrinchium angustifolium, Polygonum aviculare, Rumex mexicanus, Chenopodium capitatum, *Amaranthus retroflexus, Silene Menziesii, Stellaria calycantha, Stellaria longifolia, Stellaria longipes, *Stellaria media, Anemone canadensis, Anemone multifida* var. *hudsoniana, Thalictrum occidentale, Arabis divaricarpa, Arabis hirsuta* var. *pycnocarpa, *Brassica Kaber* var. *pinnatifida, *Capsella Bursa-pastoris, Draba nemorosa, *Neslia paniculata, Fragaria glauca, Potentilla Anserina, Potentilla multifida, Potentilla norvegica, Potentilla pennsylvanica, Viola adunca, Androsace septentrionalis, Collomia linearis, Lappula Redowskii* var. *occidentalis, Stachys palustris* var. *pilosa, Galium boreale, Aster junceus, Erigeron philadelphicus, Helianthus annuus, Artemisia biennis, Petasites sagittatus, *Sonchus oleraceus, Lactuca pulchella.*

Perhaps the most striking feature of this group is the small number of introduced European weeds (*)—only six species, or about 13.6%. None of the six, with the possible exception of *Capsella,* are abundant or become pests in the gardens. As in other parts of the central Mackenzie basin, the most numerous dooryard weeds are *Hordeum jubatum, Polygonum aviculare, Chenopodium capitatum, Capsella Bursa-pastoris, Potentilla Anserina,* and *Potentilla multifida.* None of the 44 plants listed above have become serious garden pests.

## Vegetation of the Horn and Franklin Mountains

So far as I am aware no botanist has ever visited the Horn Mountain plateau or those parts of the Franklin Mountains that fall within our area. Botanical knowledge of the Eagle Mountain Plateau is practically non-existent.

I can do no better than to quote directly the descriptions of the Horn Mountains published by the geologist E. J. Whittaker in 1922 and 1923. In 1921 Whittaker and his party ascended the Horn River and climbed to the summit of the plateau at its southeastern end. He writes, "These hills rise gradually to a height of about 1,200 feet above the plain in a distance of about 6 miles. At this height the slope is truncated by a level strip averaging 1½ miles wide, and then follows an abrupt rise of 400 to 500 feet to the top of the range, which is a plateau . . . , almost treeless, covered with caribou moss, and dotted with small ponds. One of these ponds is worthy of being called a lake, being about 1½ miles long by ¾ mile wide.

"Only the southeastern end of the range was explored. It averages 8 miles in width at this end, but apparently widens out farther to the northwest.

"The trees on the bare plateau of the range show plainly the effect of the prevailing winds. The limbs all point to the southeast, and the northwest sides of the trees are scarred and limbless. Mink, Birch, and Fawn lakes have willowy and marshy shores on the northwest sides, but the southeast sides are covered with boulders and an occasional sand or gravel beach. This is evidence of heavy wave action on the southeast sides forming a beach in each case" (1922, p. 47B; also *Plate IA*).

Whittaker again ascended the plateau in 1922, this time by way of the Rabbitskin River which enters the Mackenzie about 22 miles above Simpson. "Horn mountains in this area rise rather abruptly from this level plain to a height of about 1500 feet. The ascent is made in a gentle slope of about 300 feet in half a mile and an abrupt rise of 1200 feet in about 300 yards. From the crest the land rises very slowly for about a mile, then merges into the plateau which is covered with stunted spruce and, more rarely, poplar" (1923, p. 95B).

The botany of the Franklin Range is almost completely unknown. It is presumed to be largely timbered, but I have been unable to find any description of the amount or kind of forest. Judging by elevations given by geologists, there must be some areas of alpine vegetation.

The Ebbutt Hills, according to M. Y. Williams (1922, p. 57B), are plateau-like on top, and "covered with muskeg, black spruce, etc."

Some of the plants collected by C. L. Crickmay may have come from the Franklin Range. Many of them are alpine species that could hardly have been found in the Mackenzie lowland. Crickmay's notes read, however, "Mackenzie River, Wrigley to Blackwater R.," and "Blackwater R. to Norman."

## Plant Communities in the Brintnell Lake Area

The most prominent plant communities in the vicinity of Brintnell Lake in the Mackenzie Mountains are the forests of the lower mountain slopes, a subalpine scrub zone made up principally of willows and dwarf birch on the middle slopes, and a varied group of tundra communities at higher levels. Timber line is between 3800 and 5000 feet above sea-level; or 1200 to 2400 feet above the lake. The subalpine scrub varies greatly in vertical width, but in places covers nearly 1000 feet. Timber lines on north- and south-facing slopes in some places differ but little in elevation, although the character of the forests is quite different.

As stated elsewhere, most of the shores of the lake are precipitous, so that space for the development of communities other than those just mentioned is limited. A few small muskegs have developed, chiefly at the eastern and western ends of the lake, while in the valley of the glacial stream that enters from the west are deposits of mud upon which a marsh type of vegetation appears. The lowland along this stream also contains some gravel and sand bars that have produced characteristic communities. Large fans composed of stones and gravel occur at several places around the lake, to produce the nearest approach to beaches that the area affords.

The descriptions presented below are derived from the amalgamation of two sets of field notes. First are the records of collected specimens upon which rather copious habitat and locality data were kept. Since every effort was made to collect the entire flora of the area, these data when collated give a fairly comprehensive record of the existing habitats. Second, brief descriptions of the more important communities were prepared in the field, with lists of the species observed in given areas and photographs to illustrate typical sites. However, in spite of this attempt to form a well-rounded description of the plant life, I make no pretense whatever to completeness. The structure of the vegetation in subarctic America is notoriously fickle, and that of the Brintnell Lake region is no exception. New types of communities, or curious variations of the old ones, are sure to turn up with further examination of the country.

The following is an outline of the types of vegetation at Brintnell Lake.

FORESTS.
Lower slopes and lake shores—*Picea glauca* vars.
Higher south-facing slopes—*Picea glauca* vars.
North-facing slopes—*Picea mariana, Picea glauca* var.
Muskegs—*Picea mariana, Larix laricina* var.
Communities induced by fire.
SUBALPINE SCRUB.
ALPINE COMMUNITIES.
Damp meadows.
Stabilized scree slopes.
Slide-rock.
Ledges and crevices.
VEGETATION OF ALLUVIAL MUD AND GRAVEL DEPOSITS.
VEGETATION OF STONE AND GRAVEL LAKE BEACHES.

## *Forests*

The most mesophytic forest at Brintnell Lake is situated on the lower slopes of the mountains, extending only a few hundred feet above the level of the lake (PLATE VII). Its structure and composition are as follows:

PRIMARY SPP.: Trees: *Picea glauca* var. *albertiana.* Shrubs: *Betula papyrifera* var. *commutata, Betula papyrifera* var. *humilis, Alnus crispa, Ribes triste, Rosa acicularis, Shepherdia canadensis, Viburnum edule.* Ground: *Hypnum* spp., *Peltigera aphthosa, Vaccinium Vitis-Idaea* var. *minus.*

SECONDARY SPP.: *Cystopteris fragilis, Dryopteris fragrans, Dryopteris Linnaeana, Lycopodium annotinum* var. *pungens, Lycopodium complanatum, Corallorrhiza trifida, Cypripedium passerinum, Habenaria hyperborea, Salix arbusculoides, Salix Scouleriana* var. *coetanea, Geocaulon lividum, Actaea rubra, Ribes glandulosum, Ribes hudsonianum, Potentilla fruticosa, Rubus acaulis, Lupinus arcticus, Cornus canadensis, Moneses uniflora, Pyrola asarifolia* var. *incarnata, Pyrola grandiflora* var. *canadensis, Pyrola secunda, Pyrola virens, Arctostaphylos rubra, Linnaea borealis* var. *americana, Solidago multiradiata, Arnica alpina, Senecio lugens.*

The spruces commonly attain breast-height diameters of 2–3 feet and heights of 60–100 feet. The mat of mosses and duff in the oldest forest observed was at least 15 inches thick. The mineral substratum is usually very rough, composed principally of the larger talus rocks that have reached the lower slopes and the coarser materials of the upper parts of the alluvial fans. On sites that have not been altered by fire the heavy mat of mosses completely covers all but the largest boulders. In spite of their excellent diameter and height growth, most of the trees on the slopes have much twisted grain and a large amount of compression wood on their down-hill sides near the base. Nearly all are bent to their vertical positions from near the base, indicating that they have suffered from land-slip, or snow-slides, or both. The shrub layer is not dense, and offers but little hindrance to travel through the woods. The principal difficulties of travel are the rough, bouldery substratum and the tangle of fallen logs that are everywhere in the way.

There is but little variation in this rich forest around the lake. It is modified, however, on drier sites and on the flood plain of the glacial stream west of the lake. *Picea glauca* var. *albertiana* remains a primary species throughout, however. More xerophytic phases of the white spruce forest are found on a series of rock and gravel ridges east of the lake, on the warm south-facing slopes

below timber line north of the lake, and on the more unstable portions of the gravel fans.

East of the lake the stream that drains it soon enters a steep rapid which lies at the bottom of a picturesque winding gorge. The gorge is cut in shaly rocks whose dip is here nearly vertical. On the north side of the stream is a series of rocky and gravelly ridges separated by gently sloping plains covered with dry open woods. Occasional depressions are filled with muskegs. The open woods are composed of the following association.

PRIMARY SPP.: *Picea glauca* var. *albertiana, Betula papyrifera* var. *commutata, Hypnum* spp., *Cladonia* spp., *Cetraria* spp.

SECONDARY SPP.: *Lycopodium complanatum, Festuca altaica, Betula glandulosa, Betula occidentalis, Rosa acicularis, Lupinus arcticus.*

This forest is rather park-like, with the trees standing in a dense mat of fruticose lichens and woodland mosses. Although the list of secondary species given above is probably not complete, the total flora is quite scanty and scattered. As will be noted elsewhere in this paper, the white birches are extremely difficult to define specifically. Many of them combine the morphological characters of varieties *commutata* and *humilis*.

The higher south-facing mountain slopes north of the lake, as well as gravel fans on that side, are notable for the addition of another variety of the white spruce, *P. glauca* var. *Porsildii,* described in this paper. The smooth, balsam-like bark of this species and its more broadly pyramidal form make it easily distinguishable in stands otherwise composed of var. *albertiana*. It was rarely seen on the south side of the lake.

As one ascends the steep mountain slopes north of the lake the forest gradually becomes more open, the trees smaller, and the ground cover composed of grasses and other herbs in place of the heavy moss mat of the lower slopes (PLATE VIII). At the same time the shrub layer changes in character. The substratum remains exceedingly rough and rocky, with its surface variously broken by gullies and ridges of glacial till. Most of the slope is blanketed with bouldery till which in places is arranged in ridges whose summits slope downward to the east. These appear to be lateral moraines deposited by the glacier which last filled the valley. Streams such as Frost Creek have cut gorges in the till, paving their beds with huge boulders that have been washed out of it. The channels of these streams evidently have shifted frequently, as shown by the abandoned gullies on either side.

The forests at 1000–1500 feet above the lake may be characterized as follows:

PRIMARY SPP.: *Picea glauca* var. *albertiana, Picea glauca* var. *Porsildii, Juniperus communis* var. *montana, Arctostaphylos Uva-ursi, Festuca altaica.*

SECONDARY SPP.: *Lycopodium clavatum* var. *monostachyon, Lycopodium complanatum, Agropyron trachycaulum* var. *novae-angliae, Agrostis scabra, Calamagrostis purpurascens, Festuca brachyphylla, Poa Buckleyana, Poa nemoralis, Trisetum spicatum* var. *Maidenii, Carex atrata, Smilacina stellata, Salix arbusculoides, Salix Bebbiana, Salix glauca* var. *perstipula, Salix Scouleriana* var. *coetanea, Alnus crispa, Betula occidentalis, Betula glandulosa, Betula papyrifera* var. *commutata, Arenaria lateriflora, Arenaria verna* var. *pubescens, Aconitum delphinifolium, Anemone Richardsonii, Aquilegia brevistyla, Arabis Drummondii, Arabis Holboellii, Saxifraga tricuspidata, Amelanchier florida, Dryas Drummondii, Potentilla fruticosa, Rubus strigosus, Lupinus arcticus, Shepherdia canadensis, Epilobium angustifolium, Cornus canadensis, Vaccinium uliginosum, Vaccinium Vitis-Idaea* var. *minus, Mertensia paniculata, Pedicularis labradorica, Linnaea borealis* var. *americana, Viburnum edule, Solidago multiradiata, Antennaria isolepis, Antennaria* sp., *Artemisia arctica,* lichens (*Peltigera, Cladonia*).

This forest is park-like, with the spruces branched from near the base. Where the substratum is fairly well-stabilized the openings among the trees are grassed over with the large tufts of *Festuca altaica,* interspersed with clumps of *Juniperus* and mats of *Arctostaphylos*. Steeper slopes of gravel or loose shale, such as occur on the faces of the morainic ridges, lack most of the grasses and have only scattered *Juniperus* and *Arctostaphylos* with a few herbaceous species that manage to gain a precarious foothold. It will be seen from the list of secondary species that this high slope forest combines elements of the floras of the rich lowland woods and the subalpine scrub.

Still higher on the mountainside, nearer timber line, the flora as a whole remains the same, but a somewhat different arrangement of primary species appears. Thickets of *Betula glandulosa, Alnus crispa,* and *Salix glauca* var. *perstipula* begin to dominate the scene among the more scattered spruces, while on the loose soil of very steep slopes *Saxifraga tricuspidata, Vaccinium Vitis-Idaea* var. *minus,* and *Vaccinium uliginosum* form low, patchy thickets among the juniper bushes.

There is abundant evidence of fire on the mountainside in the neighborhood of Frost Creek. Evidence of at least two fires could be discerned, the later one probably less than 50 years ago. This later fire appears to have started near the western end of the lake and to have swept eastward and upward so as to consume all of the forest to timber line. Its eastern limit was not determined with accuracy, although from the appearance of the forest as seen from the lake it extended only a mile or so in that direction. In much older spruce forest near the shore about a mile east of Frost Creek some carbonized remains were found, indicating a much earlier fire. Other old forest in the vicinity gave no evidence of ever having been burned. It is difficult to see how these fires were started, unless they were ignited by lightning. Evidence of the presence of trappers or prospectors is all very recent, probably dating within the last 25 years, and nowhere around the lake is there any sign of Indian habitation. No old camp sites were found, and no trails other than occasional game trails.

The principal vegetational effects of the fires have been the expansion of the white birches, aspen, and balsam poplar. In many places these have become primary species in the burn forests (PLATE VII). At the same time the larger willows have become primary in the shrub layer, notably *Salix Scouleriana* var. *coetanea* and *S. arbusculoides*. These often form single-stemmed trees as much as 6 inches in diameter. On the ground there is a tangle of partly burned and slowly decaying logs. The rehabilitation of the spruce forest from this intermediate stage appears to be direct. There is little or no evidence that the fire lowered the tree line, but the size of the stumps of fire-killed trees near timber line indicates that they were much larger than those now growing there. The present trees reach a diameter of about a foot, while the stumps are often twice that.

All of the great quantity of down timber, however, cannot be attributed to the fire, for there appears to be a normally high mortality rate among the trees on the steep slopes. This appears to be due both to land-slip and snow-slides, the latter probably by far the more important. Views of the steep south-facing slopes from the mountains across the lake show what look like gullies, some of them extending all the way from timber line to lake level (PLATE III). There is a complex interwoven system of these "gullies," some of which are narrow, while others are a hundred feet or more wide. Examination on the ground

shows that they are not gullies in the ordinary sense, but great furrows in the forest, now in part overgrown with a dense tangle of willows and other shrubs of the bordering woods together with young spruce, aspen, and balsam poplar. At the foot of each furrow is an immense "jackstraw" tangle of dead logs. Neither the debris at the bottom of the slope or in the furrows themselves involves much mineral material, indicating that the damage has been done principally by sliding snow and ice.

All the trees and shrubs in the furrows are bent downward from the base and then curve upward again, indicating the repeated effects of sliding snow. The prevalence of this form on all the steeper slopes suggests that the damage done by snow is general, though not always concentrated in channels. It probably accounts for a large part of the fallen timber.

At first glance the relative openness of the snow-slide furrows suggests that they would be good routes for climbing the mountain. Our party tried one but was very quickly disillusioned. The mass of debris on the ground and the matted tangle of downward-pointing branches on the distorted shrubs make climbing far more exhausting than it is in the neighboring forest.

The snowslide channels are seen only on very steep south-facing slopes. It is presumed that they are caused by the early loosening of snow during spring thaws at and above timber line. Insolation would no doubt be more rapid here than under cover of forests at lower levels.

The great fans of gravel and stones that occur around the lake (PLATE IV) apparently are formed by torrential floods. The size of trees growing in the more active channels near the shore indicates that such floods are not frequent. None occurred during the season of 1939 that caused any noticeable displacement of materials. In what part of the open season the floods come is not known, but it is assumed that they come in late spring or early summer. Our field party of 1943 experienced such a flood in the Summit Pass area along the Alaska Highway. It came early in July, following a hard rain which lasted for about 36 hours. Boulders several feet in diameter were moved by this flood, and immense quantities of rock debris were shifted in the mountain gullies and alluvial fans. Here again there was good evidence that at least a quarter of a century had elapsed since a similar flood had occurred.

The surfaces of the fans are covered with gravel, stones, and boulders, the finer of which are nearest the lake. The general contours are of varying steepness depending upon the size of the materials. The slope of the one at the mouth of Frost Creek is rather gentle, about 200 feet in 1600; but some of those on the south shore, composed of large rocks from the steep north slopes of Colonel Mountain, have a much larger gradient, about 200 feet in 1000. The contours are broken by interlocking abandoned channels, some of which will no doubt become active again with the next flood.

The vegetation on the fans is an open forest of spruce, balsam poplar and large willows, interspersed with areas of nearly barren gravel or dense thickets of shrubs and young trees (PLATE XII). The flatter parts which receive sufficient drainage, usually at the sides of the main channels, sometimes harbor muskegs. The drier parts proved to be of considerable floristic interest because of the heterogeneous mixture of species growing on them. Their flora is drawn not only from the woods and shores around the lake, but also from the alpine vegetation far above. The following list contains species found in the open woods and thickets, and is made up from observations and collections on several

different fans. For a more complete account of the flora of these sites the list should be supplemented with one given below in the discussion of alpine plants at lake level.

PRIMARY SPP.: *Picea glauca* var. *albertiana, Picea glauca* var. *Porsildii, Betula papyrifera* var. *humilis, Betula papyrifera* var. *commutata, Alnus crispa, Salix planifolia, Salix alaxensis* var. *longistylis, Viburnum edule, Shepherdia canadensis, Rosa acicularis.*

SECONDARY SPP.: *Agropyron latiglume, Agropyron trachycaulum* var. *novae-angliae, Arctagrostis arundinacea, Calamagrostis canadensis* var. *robusta, Festuca brachyphylla, Poa alpina, Poa arctica, Poa Brintnellii, Poa glauca, Carex atrata, Salix Bebbiana, Salix commutata, Salix Scouleriana* var. *coetanea, Stellaria calycantha, Anemone parviflora, Arabis Holboellii, Cardamine bellidifolia, Draba McCallae, Saxifraga radiata, Saxifraga tricuspidata, Geum macrophyllum* var. *perincisum, Rubus strigosus, Sibbaldia procumbens, Epilobium angustifolium, Epilobium lactiflorum, Pedicularis sudetica, Campanula lasiocarpa, Erigeron angulosus* var. *kamtschaticus, Artemisia Tilesii, Taraxacum alaskanum, Taraxacum lacerum, Taraxacum ceratophorum.*

On more undisturbed parts of the fans this open forest merges imperceptibly with the rich spruce woods already described. A moss mat appears on the ground, and woodland species of shrubs predominate to the exclusion of others. As previously noted, the smooth-barked spruce, *P. glauca* var. *Porsildii*, is a primary species only on the north side of the lake. Its occurrence on the south side appeared to be limited to the lowermost parts of some of the fans.

Still another type of white spruce forest has developed on the mud, sand, and gravel flats west of Brintnell Lake. It is rather open and park-like, with a mat of mosses that is thin and much interrupted.

PRIMARY SPP.: *Picea glauca* var. *albertiana, Picea glauca* var. *Porsildii, Populus Tacamahacca, Alnus tenuifolia, Equisetum palustre, Hypnum* spp.

SECONDARY SPP.: *Arctagrostis arundinacea, Calamagrostis canadensis* var. *robusta, Poa pratensis, Cerastium Beeringianum, Aconitum delphinifolium, Parnassia palustris* var. *neogaea, Ribes lacustre, Ribes oxyacanthoides, Rosa acicularis, Hedysarum alpinum* var. *americanum, Oxytropis hyperborea, Oxytropis foliolosa, Moneses uniflora, Pyrola asarifolia* var. *incarnata, Pyrola secunda, Arctostaphylos rubra, Mertensia paniculata, Solidago multiradiata.*

This forest resembles flood plain types in other parts of the Mackenzie basin. It is of interest that *Equisetum palustre* here forms dense green swards on the forest floor, much as *E. pratense* does along the Slave, Peace, and Athabaska Rivers. Possible developmental sequences leading to the spruce forests west of the lake will be discussed in another place.

Most of the forests on the north-facing slopes fronting Brintnell Lake are radically different from those just described. White spruce timber similar to the more mesophytic type already noted occurs south of the lake, but is confined to the more stable portions of the alluvial fans, reaching only about 200 feet above the shore. With one exception, which occurs near timber line, the forests of the higher slopes are of black spruce, *Picea mariana.*

The northerly slope of Colonel Mountain consists of a series of great gullies separated by sharp "hogbacks" which extend nearly to the summit (about 7300 feet above sea level) (PLATE IV). The hogbacks are the products of an erosion interval that extended through at least one interglacial period. Their lower portions were removed to an elevation of about 4300 feet by the last advance of the ice, so that they are now terminated by great triangular facets that reach about 1700 feet above the lake. The facets have a gradient of about 34°, and are clothed with forest to about 4000 feet, or about 1400 feet above the lake.

The steep slopes are rocky, but they are covered for the most part by a thick mat of fruticose lichens and woodland mosses. This mat is often a foot or more in depth and is nearly always damp. It thins out gradually toward timber line so that the underlying rocks begin to be exposed. The forest is an open one even at lake level, but it becomes still more so at higher elevations (PLATE VIII). The general aspect of the north-facing mountainsides is strikingly different from that of the opposite slopes, due to the peculiar greens of the fruticose lichens. These greens are particularly noticeable, of course, in wet weather, and contrast sharply with the higher grassy slopes north of the lake.

There is a certain amount of change in vegetation from bottom to top of the forested zone, but except for a narrow zone at the top the whole is sufficiently uniform to justify treating it as a unit. The following list is a general one, therefore, and will be followed by notes on the principal variations.

PRIMARY SPP.: Trees: *Picea mariana.* Shrubs: *Salix glauca* var. *perstipula, Alnus crispa, Ledum groenlandicum, Vaccinium uliginosum.* Ground: *Cladonia, Cetraria, Hypnum* spp., *Arctostaphylos rubra, Equisetum scirpoides, Andromeda Polifolia.*

SECONDARY SPP.: *Arctagrostis arundinacea, Festuca altaica, Carex scirpoidea, Carex vaginata, Tofieldia palustris, Corallorrhiza trifida, Goodyera repens* var. *ophioides, Habenaria obtusata, Salix alaxensis, Salix reticulata, Betula papyrifera* var. *humilis, Geocaulon lividum, Oxyria digyna, Silene acaulis* var. *exscapa, Stellaria longipes* var. *Edwardsii, Saxifraga tricuspidata, Dryas integrifolia, Rosa acicularis* var. *cucurbiformis, Astragalus frigidus* var. *littoralis, Hedysarum alpinum* var. *americanum, Lupinus arcticus, Epilobium latifolium, Pyrola secunda, Cassiope tetragona, Vaccinium microcarpum, Vaccinium Vitis-Idaea* var. *minus, Mertensia paniculata, Pedicularis capitata, Pedicularis labradorica, Boschniakia rossica, Pinguicula villosa.*

The primary species just noted are characteristic up to 500–600 feet above the lake. Above this general level *Salix Richardsonii* and *Betula glandulosa* are added to those of the shrub layer, and *Dryas integrifolia* becomes an important component of the ground mat. The white birches disappear almost entirely from the association. Otherwise the aspect is much the same except that the black spruces are more dwarfed and more widely spaced.

The upper 200–300 feet of the forest has a superficial resemblance to that below, but closer examination shows a striking change. The black spruce is replaced by *Picea glauca* var. *albertiana*, while the shrub and ground floras show a transition to the subalpine and alpine vegetation.

PRIMARY SPP.: Trees: *Picea glauca* var. *albertiana.* Shrubs: *Salix glauca* var. *perstipula, Salix Richardsonii, Betula glandulosa.* Ground: *Cladonia, Cetraria, Hypnum* spp., *Cassiope tetragona, Vaccinium uliginosum, Dryas integrifolia, Carex scirpoidea.*

*Ledum groenlandicum* drops to a secondary position in the community, while a few species such as *Equisetum scirpoides, Corallorrhiza trifida, Goodyera repens* var. *ophioides, Habenaria obtusata, Rosa acicularis* var. *cucurbiformis, Pyrola secunda, Vaccinium microcarpum,* and *Pinguicula villosa* become very rare or drop out altogether. At the same time some additions are made: *Shepherdia canadensis, Oxytropis ixodes, Empetrum nigrum,* and *Abies lasiocarpa.* This is the timber line community on the north-facing slopes. It gradually gives way to a subalpine scrub or to some form of alpine tundra, depending upon slope, exposure, or substratum. It is broken here and there by exposed cliffs of shale on which there is a ledge and crevice flora (see below), or by gullies in which the willows and alders make dense tangles of shrubbery.

We saw no evidence of fire in any part of the communities on the north-facing slopes. Consequently I am unable to suggest what its effects would be.

Muskegs were observed on the low ground at both ends of Brintnell Lake, and on various local areas of small size on the mountain slopes and lake shores. The following is a general account of their structure and flora drawn from all these sources:

PRIMARY SPP.: *Picea mariana, Larix laricina* var. *alaskana, Ledum groenlandicum, Sphagnum* sp.

SECONDARY SPP.: *Equisetum scirpoides, Equisetum sylvaticum* var. *pauciramosum, Equisetum variegatum, Selaginella selaginoides, Arctagrostis arundinacea, Calamagrostis canadensis* var. *robusta, Poa pratensis, Eriophorum brachyantherum, Carex aurea, Carex capillaris, Carex concinna, Carex gynocrates, Carex leptalea, Carex loliacea, Carex media, Carex membranacea, Carex scirpoidea, Carex vaginata, Juncus castaneus, Tofieldia palustris, Corallorrhiza trifida, Cypripedium passerinum, Habenaria hyperborea, Habenaria obtusata, Listera borealis, Salix Barclayi, Salix commutata, Salix glauca* var. *perstipula, Salix myrtillifolia, Salix reticulata, Salix Richardsonii, Alnus crispa, Alnus tenuifolia, Betula glandulosa, Arenaria lateriflora, Anemone parviflora, Ranunculus hyperboreus, Ranunculus lapponicus, Cardamine pratensis, Rorippa islandica* var. *microcarpa, Chrysosplenium tetrandrum, Parnassia Kotzebuei, Parnassia palustris* var. *neogaea, Ribes hudsonianum, Geum macrophyllum* var. *perincisum, Potentilla fruticosa, Rubus Chamaemorus, Rubus acaulis, Hedysarum alpinum* var. *americanum, Oxytropis ixodes, Empetrum nigrum, Epilobium davuricum, Epilobium latifolium, Andromeda Polifolia, Arctostaphylos rubra, Cassiope tetragona, Vaccinium microcarpum, Vaccinium uliginosum, Gentiana propinqua, Pedicularis capitata, Pedicularis sudetica, Boschniakia rossica, Pinguicula villosa, Valeriana septentrionalis, Aster sibiricus, Erigeron elatus, Antennaria monocephala, Senecio indecorus, Senecio lugens, Senecio pauperculus, Taraxacum ceratophorum, Taraxacum lacerum, Taraxacum lapponicum.*

Pools and shores in the muskegs have a few floating or emergent aquatics such as *Hippuris montana, Ranunculus Gmelini* var. *Purshii, Carex aquatilis, Carex physocarpa, Carex diandra,* and *Juncus balticus.* Aquatic communities are, however, very poorly represented in or around Brintnell Lake. No species of *Potamogeton, Nuphar, Myriophyllum, Ceratophyllum,* or *Sparganium* were seen.

A cursory examination of the above list will show at once that the bulk of the muskeg flora is typical of this habitat throughout most of the northwest. A few species, such as *Carex membranacea, Juncus castaneus, Salix reticulata, Salix Richardsonii, Parnassia Kotzebuei, Cassiope tetragona,* and *Gentiana propinqua,* have a strong tundra affinity; but most are of wide range in the subarctic forests of the continent. No raised bogs were seen, but on gentle, well-watered slopes the muskegs have a tendency, as in so many parts of the north, to spread upward. Some modifications of water levels and muskeg communities were seen along a sluggish tributary stream in the flats west of the lake, but no detailed studies of them were made. The changes were caused by beaver dams.

### *Subalpine scrub communities*

A shrub zone, or subalpine scrub, is not well defined on all the mountain slopes at Brintnell Lake. It is best seen on Red and Terrace Mountains north of the lake, though even here it varies greatly in prominence and vertical width (PLATE III). Willows and dwarf birch make up most of it. On the steep north slopes of the glaciated facets of Colonel Mt. and on the hogbacks above them, it can scarcely be discerned at all, but on the flanks of the hogbacks there is usually a narrow band of shrubs which widens out somewhat in the intervening valleys. Here it occupies a strip probably less than 100 feet wide in vertical dimension.

The lip of the hanging valley from which Frost Creek falls into the main valley of the lake is at about 3800 feet above sea-level, or about 1200 feet above the lake. The upper valley of Frost Creek is U-shaped below 5000 feet and evidently contained a tributary glacier at one time. A well-defined terrace of till appears on its flanks at about 5000 feet. Timber line on the south-facing slopes seems to be modified by the presence of the hanging valley. On Red and Terrace Mountains east and west of the Frost Creek valley it rises to nearly 5000 feet, but within the hanging valley itself there are only a few scattered and stunted trees above 4000 feet. Above timber on the south slopes there is only a narrow zone of scrub, which disappears completely on the steeper areas. This zone is greatly expanded in the hanging valley. It covers most of the valley bottom and the lateral slopes up to the tops of the morainic terraces, or to about 5000 feet. It thus achieves a vertical width of about 1000 feet.

Floristically the subalpine scrub is a transition, drawing most of its species from above and below. The following is a composite list made up from notes gathered on both sides of the lake.

PRIMARY SPP.: *Betula glandulosa, Salix glauca* var. *perstipula, Empetrum nigrum, Phyllodoce glanduliflora, Cassiope tetragona, Festuca altaica.*

SECONDARY SPP.: *Lycopodium alpinum, Lycopodium complanatum, Abies lasiocarpa, Picea glauca* var. *albertiana, Juniperus communis* var. *montana, Agrostis scabra, Calamagrostis canadensis* var. *robusta, Poa arctica, Poa alpina, Trisetum spicatum* var. *Maidenii, Carex atrata* ssp. *atrosquama, Carex phaeocephala, Carex Soperi, Carex podocarpa, Carex pyrenaica, Carex scirpoidea, Carex vaginata, Luzula Wahlenbergii, Lloydia serotina, Zygadenus elegans, Cypripedium passerinum, Salix alaxensis, Salix arctica, Salix Barrattiana, Salix Barrattiana* var. *marcescens, Salix commutata, Salix planifolia, Salix reticulata, Salix Richardsonii, Oxyria digyna, Polygonum viviparum, Silene acaulis* var. *exscapa, Aconitum delphinifolium, Anemone narcissiflora, Anemone Richardsonii, Delphinium glaucum, Arabis Drummondii, Arabis lyrata* var. *kamchatica, Sedum roseum* var. *integrifolium, Saxifraga Lyallii, Saxifraga punctata, Saxifraga tricuspidata, Dryas integrifolia, Astragalus frigidus* var. *littoralis, Hedysarum alpinum* var. *americanum, Oxytropis hyperborea, Viola epipsila, Shepherdia canadensis, Cornus canadensis* f. *purpurascens, Vaccinium Vitis-Idaea* var. *minus, Polemonium acutiflorum, Pedicularis capitata, Pedicularis labradorica, Veronica alpina* var. *unalaschcensis, Linnaea borealis* var. *americana, Erigeron unalaschkensis, Antennaria isolepis, Artemisia arctica, Petasites frigidus, Arnica alpina, Senecio lugens, Senecio triangularis, Hieracium gracile.*

A few species were found at Brintnell Lake only in the subalpine scrub zone: *Carex Soperi, Saxifraga Lyallii, Viola epipsila, Cornus canadensis* f. *purpurascens, Petasites frigidus,* and *Senecio triangularis.* Some of these were quite rare, and none were common except locally.

Another small group, though found elsewhere on the mountains, appeared to be especially abundant in the scrub. These are: *Lycopodium alpinum, Abies lasiocarpa, Luzula Wahlenbergii, Salix Barrattiana* and var. *marcescens, Delphinium glaucum, Aconitum delphinifolium, Polemonium acutiflorum,* and *Pedicularis labradorica.*

A few alpine species achieve their lowest limits in the scrub: *Lycopodium alpinum, Carex phaeocephala, Carex podocarpa, Lloydia serotina, Salix arctica, Salix Barrattiana* and var. *marcescens, Anemone narcissiflora, Delphinium glaucum, Sedum roseum* var. *integrifolium, Saxifraga punctata, Phyllodoce glanduliflora, Veronica alpina* var. *unalaschcensis, Erigeron unalaschkensis,* and *Hieracium gracile.* Lower slope species that here reach the upper limits are as follows: *Abies lasiocarpa, Picea glauca* var. *albertiana, Agrostis scabra, Calamagrostis canadensis* var. *robusta, Carex vaginata, Luzula Wahlenbergii, Cypri-*

*pedium passerinum, Salix commutata, Salix planifolia, Arabis Drummondii,* and *Antennaria isolepis.*

Thus in spite of its discontinuous distribution and variable width, the subalpine scrub is seen to have a certain amount of floristic individuality, and at the same time to constitute a meeting-ground for alpine and lower slope plants. Of the 69 species listed for the whole zone, 15, or about 21.7%, may be regarded as fairly characteristic. Twenty-five plants, or about 36.2%, reach their upper or lower limits in the scrub. There is a small amount of overlap in the categories just mentioned, but the scrub as a habitat appears to have some particular significance for a little over 50% of the species that grow there.

Some mention should be made of local geographic variations in the structure of the scrub communities. At timber line in the valley of Frost Creek the principal species are the willows, which form dense thickets 4–6 feet high. Along the stream itself *Salix alaxensis* becomes a primary species in place of *S. glauca* var. *perstipula.* At higher elevations the shrubs of all kinds become dwarfed, and at the upper limits of the zone are often no more than a foot high. On the south and southeast slopes of Red Mountain the willows outnumber the dwarf birches; but on the east slope, as well as on the terraces of Terrace Mountain, dwarf birch forms nearly pure stands. *Cassiope* and *Phyllodoce* are much more prominent on the northeasterly slope of Red Mountain than elsewhere.

Throughout the scrub zone, but particularly toward its upper parts, the continuity of the thickets is much broken by grassy openings in which *Festuca altaica* is a primary species. Most of the sedges and grasses as well as many of the other herbaceous plants mentioned in the list are found in these openings. A few, such as *Delphinium, Aconitum,* and *Polemonium,* seem to find their most congenial habitat in the dense thickets. These thickets are difficult to climb through because their interlaced branches are depressed downward like those described in the snowslide areas.

### *Alpine vegetation*

It is nearly impossible to organize the alpine vegetation into clear-cut communities. In some places the plants form a fairly continuous turf in which interrelationships among plants probably are developed, but over most of the alpine surfaces interdependencies among species are difficult or impossible to define. It is doubtful whether these loose aggregations of plants can be called communities in the usual ecological sense. Their composition and distribution are determined very largely by the physical nature of the substratum, and since this is the case it seems best to organize them in terms of the substratum.

The nature of the alpine plant cover depends in large measure upon the stability of the soil and the amount of water at or near the surface. Both of these factors in turn are dependent for their expression upon the relative friability of the underlying rock, the degree of slope, the degree of consolidation of the material in case it is a glacial till, and the length of time since the surface was exposed by the glaciers. With regard to the last of these conditions it seems reasonable to assume that most of the alpine surfaces around Brintnell Lake are somewhat older than those now under forest and subalpine scrub. Evidence to this effect is in the upper limit of obvious glacial erosion in the main valley of the lake (about 4300 feet), and the upper limits of the younger till on the slopes of Red and Terrace Mountains (about 5000 feet). The date of the last

advance of the ice is not known, nor is the length of the interval between this and the preceding one.

It is possible to make a rough division of the alpine vegetation on the basis of the stability of the surface, with subdivisions related to the size of the materials and their drainage conditions.

Soils essentially stable, though still subject to slow creep.
  Alpine "meadows," in which the soil is mostly covered by a turf.
    1. "Damp meadows" along streams and in snow-flush areas.
    2. "Dry meadows" on stabilized slide rock.
Soils in active motion at frequent intervals.
  Steep slopes of slide rock.
    3. Plants scattered in loose slide rock.
    4. Plants in turfy banks or terraces.
Soil kept in motion by frost heaving on level or gently sloping surfaces.
    5. Plants scattered in heaved soil or in turf at the margins of polygons.
Crevices and ledges.
    6. Plants scattered or in turf.

It must be kept in mind that these subdivisions constitute only a working scheme for the description of the alpine vegetation in the immediate vicinity of Brintnell Lake. They do not account for types of alpine habitats such as lake shores which were not observed there. Furthermore they are clearly defined only in their extreme forms, and every conceivable intergradation among them can be found. On the other hand the scheme takes cognizance of an environmental influence which is probably of first importance in the determination of the content and distribution of arctic-alpine vegetation. This is the action of frost in the break-up of the parent rock and in the subsequent movement of the fine materials to a state of rest. The influence of the vegetation in furthering the latter process has been clearly recognized by such students as Antevs (1932) and Polunin (1934–35), and Polunin (l. c.) has pointed out the historical significance of the counter-influence of solifluction upon the development of the vegetation.

Lack of success in defining alpine plant communities in the usual terms of primary and secondary, or dominant and incidental species can be logically accounted for by the long-continued frost action in alpine habitats. This factor probably has been in effect during all of the Glacial and post-Glacial period, so that the whole history of the occupance by plants of such alpine habitats as occur in the Mackenzie Mountains is one of vegetational instability.

With these things in view it may well be advisable to give up trying to describe a great deal of our alpine and arctic vegetation in terms of plant associations, and to institute methods that will recognize the significance of a state of continuing instability. I have already discussed the difficulties that arise from too close adherence to the prescribed ecological methods (1941; see also Griggs, 1934). In the ensuing descriptions it is to be understood that the term "primary species" is significant chiefly as a measure of frequency except in some of the most stable meadow types.

Before beginning an account of the alpine vegetation some preliminary considerations are necessary. It will be noted that all our data on this type of habitat were gathered on the mountains of sedimentary rock. The granite peaks to the westward of Brintnell Lake were inaccessible in the time available, and probably are unscalable. Examined through field glasses they appeared to be nearly sterile, with the cliffs exfoliating so rapidly as to make plant life nearly

impossible. The great talus at the foot of Mt. Harrison Smith, which appears in PLATE III, is practically devoid of plants in many places, even nearly down to lake-level.

A curious phenomenon of local distribution may also be pointed out here. A number of species were found to be absent or rare on one or the other of the mountains north and south of the lake. The following are incomplete lists which will illustrate this.

Common on the north slope of Colonel Mt., but absent or only rare or occasional on Red and Terrace Mountains: *Zygadenus elegans, Tofieldia palustris, Salix Barrattiana, Salix Richardsonii, Oxyria digyna, Silene acaulis* var. *exscapa, Stellaria longipes* var. *Edwardsii, Arenaria Rossii, Lychnis apetala, Saxifraga oppositifolia, Saxifraga aizoides, Astragalus frigidus* var. *littoralis, Hedysarum alpinum* var. *americanum, Oxytropis Maydelliana, Oxytropis pygmaea, Oxytropis hyperborea, Oxytropis ixodes, Epilobium latifolium, Pedicularis capitata, Senecio lugens, Crepis nana.*

Common on the slopes of Red or Terrace Mountains, but rare or absent on the north side of Colonel Mt.: *Lycopodium alpinum, Lycopodium Selago, Hierochloë alpina, Poa arctica, Carex albo-nigra, Luzula confusa, Luzula spicata, Luzula arcuata, Corydalis pauciflora, Phyllodoce glanduliflora, Gentiana glauca, Veronica alpina* var. *unalaschcensis, Erigeron eriocephalus, Erigeron jucundus, Arnica mollis, Arnica alpina* ssp. *tomentosa.*

Causes for these differences were not determined. They could be looked for in local climatic differences due to north and south exposure, or to variations in the chemical nature of the substratum. It is probable that there is more calcium in the rocks south of the lake than north of it, due to an abundance of calcite stringers in the shale. The flora of Colonel Mountain bears a closer resemblance to the extremely calcicolous communities described by Porsild (1945) on the "Plains of Abraham" along the Canol Road than does that of Red and Terrace Mountains (see below).

*Damp alpine meadows*

Damp alpine meadows at Brintnell Lake are best developed along small brooks where the latter flow over terraces of glacial till or other soil containing fines. They also appear on moderately sloping surfaces where snow lies in depressions well into the summer. Here the substratum may be of coarser debris because of the continued source of water from the melting snow. These snow-flush areas are commonly not so rich in species or individuals as brook valleys, for they are apt to become quite dry in late summer. Damp meadows make up, together, only a small part of the alpine vegetation, for surface water above timber line in these mountains is not common. They are usually formed in a thick turf which gives the impression of permanence and stability. It is common, however, to see large masses of this turf breaking up by transverse crevasses which produce an appearance of draped festoons when seen at a distance. They are thus constantly being dissected, later to form continuous mats again a little lower down the slopes.

PRIMARY SPP.: *Salix alaxensis, Salix glauca* var. *perstipula, Salix Richardsonii, Salix Barrattiana, Betula glandulosa, Carex podocarpa, Festuca altaica.*

SECONDARY SPP.: *Equisetum arvense, Equisetum variegatum, Arctagrostis arundinacea, Hierochloë alpina, Poa arctica, Carex atrata* ssp. *atrosquama, Carex deflexa, Carex nesophila, Luzula arcuata, Luzula spicata, Lloydia serotina, Salix arctica, Salix reticulata,*

*Oxyria digyna, Polygonum viviparum, Arenaria sajanensis, Aconitum delphinifolium, Anemone narcissiflora, Anemone parviflora, Anemone Richardsonii, Delphinium glaucum, Ranunculus Eschscholtzii, Ranunculus nivalis, Corydalis pauciflora, Cardamine bellidifolia, Draba longipes, Draba McCallae, Sedum roseum* var. *integrifolium, Parnassia fimbriata, Parnassia Kotzebuei, Saxifraga punctata, Saxifraga rivularis, Potentilla diversifolia* var. *glaucophylla, Sibbaldia procumbens, Astragalus frigidus* var. *littoralis, Epilobium anagallidifolium, Pyrola minor, Cassiope tetragona, Gentiana glauca, Polemonium acutiflorum, Mertensia paniculata, Myosotis alpestris* ssp. *asiatica, Pedicularis labradorica, Veronica alpina* var. *unalaschcensis, Campanula lasiocarpa, Erigeron eriocephalus, Erigeron unalaschkensis, Antennaria monocephala, Artemisia arctica, Arnica Lessingii, Hieracium gracile, Taraxacum alaskanum.*

The above list is of course a composite one, made up from various situations. Nevertheless in some localities nearly all of the species may be found in close proximity. The willows are mostly concentrated along the streams or snow-flush channels, while the grasses, sedges, and other herbaceous plants form the turf on either side, with occasional willows and dwarf birches scattered here and there. On many sites there is no small group of species that can be designated as primary, for the community is a hodge podge mixture of many.

*Dry alpine meadows*

Dry alpine meadows as I have conceived them here include a great variety of plant groupings. They occupy erosion and solifluction slopes that are fairly well stabilized but which have no continuous source of surface water except in the spring when most of the snow is melting. The mineral substratum is made of angular fragments of slate and shale, in some places comminuted to form a few inches of residual soil.

With the possible exception of slide rock, this type of vegetation covers more area than any other in the Brintnell Lake region. The long, even slopes of the gently rolling ancient surface seen from the air in the eastern parts of the Mackenzie Mountains are covered with it. It is represented at Brintnell Lake on the summits of Red and Terrace Mountains, and probably on the upper south-facing slopes of Colonel Mt. It also appears on the lower parts of the great talus accumulations between 4000 and 6000 feet.

The primary group of species in the dry meadows varies greatly with exposure and the relative stability of the soil. Before noting these variations I shall give a list of all the species observed in the dry meadows.

*Woodsia ilvensis, Lycopodium alpinum, Lycopodium annotinum* var. *alpestre, Lycopodium complanatum, Lycopodium Selago, Picea glauca* var. *albertiana* (occasional dwarfs), *Juniperus communis* var. *montana, Agropyron latiglume, Calamagrostis lapponica, Calamagrostis purpurascens, Festuca altaica, Festuca brachyphylla, Hierochloë alpina, Poa alpina, Poa arctica, Poa glauca, Trisetum spicatum* var. *Maidenii, Carex bipartita, Carex nardina* var. *Hepburnii, Carex phaeocephala, Carex podocarpa, Carex pyrenaica, Carex scirpoidea, Luzula arcuata, Luzula confusa, Luzula spicata, Tofieldia palustris, Zygadenus elegans, Salix arctica, Salix glauca* var. *acutifolia, Salix glauca* var. *perstipula, Salix pulchra, Salix reticulata, Betula glandulosa, Oxyria digyna, Polygonum viviparum, Arenaria sajanensis, Arenaria verna* var. *pubescens, Silene acaulis* var. *exscapa, Stellaria longipes* var. *Edwardsii, Aconitum delphinifolium, Anemone narcissiflora, Anemone parviflora, Draba fladnizensis* var. *heterotricha, Draba glabella, Sedum roseum* var. *integrifolium, Saxifraga oppositifolia, Saxifraga tricuspidata, Dryas integrifolia, Dryas octopetala, Potentilla diversifolia* var. *glaucophylla, Potentilla emarginata, Potentilla fruticosa, Potentilla nivea, Potentilla uniflora, Rosa acicularis, Astragalus frigidus* var. *littoralis, Hedysarum alpinum* var. *americanum, Hedysarum Mackenzii, Lupinus arcticus, Oxytropis hyperborea, Oxytropis ixodes, Oxytropis Maydelliana, Oxytropis pygmaea, Empetrum nigrum, Shepherdia canadensis, Epilobium angustifolium, Epilobium latifolium,*

*Pyrola asarifolia* var. *incarnata, Pyrola secunda, Arctostaphylos rubra, Cassiope tetragona, Ledum groenlandicum, Phyllodoce glanduliflora, Vaccinium uliginosum* var. *alpinum, Vaccinium Vitis-Idaea* var. *minus, Gentiana glauca, Gentiana propinqua, Polemonium acutiflorum, Mertensia paniculata, Myosotis alpestris* ssp. *asiatica, Pedicularis capitata, Pedicularis labradorica, Pedicularis lanata, Veronica alpina* var. *unalaschcensis, Linnaea borealis* var. *americana, Campanula lasiocarpa, Solidago multiradiata, Antennaria media, Antennaria monocephala, Artemisia arctica, Arnica alpina, Arnica Snyderi, Senecio lugens, Hieracium gracile.*

This is by far the largest single assemblage of plants on the alpine areas, or for that matter in any of the Brintnell Lake habitats. Over 60% of all the species found above the subalpine scrub are here. In no one place, however, is so large a proportion of them found together as is the case of the group in damp meadows.

Variations in general aspect of the dry meadows can best be shown by field notes made on primary species in various situations. The most complex aggregations are on slopes of northern and eastern exposure. Here a nearly continuous turf is sometimes formed, in which the primary species are *Dryas integrifolia, Cassiope tetragona, Festuca altaica, Salix reticulata, Carex scirpoidea, Vaccinium uliginosum* var. *alpinum,* and mats of dwarfed *Betula glandulosa. Phyllodoce glanduliflora* and *Empetrum nigrum* are sometimes added to the group. This complex was observed on the north slopes of Colonel Mt. and on the north and east slopes of Red Mt.

The alpine surface of Red Mountain shows further variation as follows. At about 4800 feet on the south-facing slope is a rather open association of *Vaccinium uliginosum* var. *alpinum, Festuca altaica,* and a partial cover of lichens. Among the latter the xerophytic *Stereocaulon* is predominant. *Betula glandulosa* and *Salix glauca* var. *acutifolia* are common in widely spaced, low mats. At about 5900 feet, on the rounded slopes of the summit, the primary species are *Dryas octopetala, Vaccinium uliginosum* var. *alpinum,* and a lichen mat made up of *Cladonia* and *Cetraria.* Most of the ground is covered, but here and there are open areas of loose shale or finer soils kept barren by frost action. In depressions where snow had lain for a large part of the summer *Phyllodoce glanduliflora* is abundant.

The highest point of Red Mt. is a narrow ridge on which a thin soil has weathered out of the shale. The most abundant plants are *Festuca brachyphylla, Poa arctica,* and a loose mat of *Cladonia* and *Cetraria.* In a few places there are mats of *Vaccinium uliginosum* var. *alpinum* and *Cassiope tetragona.* The whole association is open, with much ledge and loose shale exposed.

Just east of the summit, at the beginning of a long slope of fairly well stabilized talus, the aspect changes at once. Here the primary species become *Festuca altaica, Cassiope tetragona, Dryas octopetala, Vaccinium uliginosum* var. *alpinum,* and masses of fruticose lichens. At 5000–5500 feet on the easterly and northeasterly slopes this group is enlarged by the addition of *Empetrum nigrum,* and becomes the turf community described above.

Some contrasts can be seen among these complexes even from a distance. On some south-facing slopes *Festuca altaica* is very prominent, due to the small development of other species with it. It is a bunch grass that grows in large tufts often a foot or two thick and well separated from one another. When growing thus it can be distinguished from far away, but it disappears when mixed with many other species.

*Plants of loose slide rock and turf-banked terraces*

Slide rock of loose, angular shale fragments is of wide occurrence above timber line at Brintnell Lake. In some places whole mountainsides are composed of continuous "rivers" of this shale (PLATES IX, X). The parent rock does not always break up into small pieces, however, so that here and there are masses of coarser material, forming steep slopes of large angular boulders. The shale is highly mobile, but the boulder fields are more or less stabilized and possess a flora similar to that of crevices and ledges. Only plants whose water requirements are low, and whose root and rhizome systems are adaptable in the extreme can live in the loose shale. The following is a list of those observed or collected:

*Woodsia ilvensis, Carex albo-nigra, Carex nardina* var. *Hepburnii, Carex nesophila, Carex phaeocephala, Carex podocarpa, Luzula arcuata, Luzula confusa, Luzula spicata, Zygadenus elegans, Salix arctica, Salix glauca* var. *acutifolia, Salix glauca* var. *perstipula, Salix pulchra, Arenaria Rossii, Arenaria sajanensis, Arenaria verna* var. *pubescens, Lychnis apetala, Stellaria longipes* var. *Edwardsii, Aconitum delphinifolium, Arabis lyrata* var. *kamchatica, Draba cinerea, Draba lanceolata, Draba nivalis* var. *elongata, Draba praealta, Saxifraga aizoides, Saxifraga tricuspidata, Dryas Drummondii, Dryas integrifolia, Dryas octopetala, Hedysarum Mackenzii, Oxytropis Maydelliana, Oxytropis pygmaea, Campanula lasiocarpa, Solidago multiradiata, Aster sibiricus, Erigeron jucundus, Arnica mollis, Arnica Lessingii, Arnica alpina* ssp. *tomentosa, Arnica Snyderi, Crepis nana.*

Except in certain instances to be described below, this assemblage of plants cannot be called a community in any sense. The shale is scarcely more than at an angle of rest, so that a touch is all that is needed to set it in motion. Most of the plants are widely scattered, and there are large areas completely devoid of vegetation of any kind. Roots and rhizomes are usually just beneath the surface and nearly always extend *up* the slopes from the aerial parts of the plants. From a tiny, dwarfed herbaceous perennial, all alone in the loose and sliding shale and giving every appearance of being a chance seedling, one often can excavate an elaborate system of rhizomes and roots extending many feet up the slope and giving evidence of great age. Some plants of tufted habit seem to slide with the shale without serious damage.

There is, of course, every kind of transition between the completely open aggregations and the more or less stable communities described above as dry alpine meadows. Only one of these stages need be given special notice. Some of the more or less woody species which are most efficient in their mat-forming proclivities, especially *Dryas integrifolia, Saxifraga tricuspidata, Cassiope tetragona, Salix glauca* var. *acutifolia,* and *Salix arctica,* may form mats of interlaced stems and roots that can cling together in spite of the movement of the shale. On the mats thus formed other plants can find at least temporary security, and sometimes small areas of turf are formed, involving mosses and fruticose lichens.

Many shale slopes have the appearance of being festooned with bands of vegetation, or streaked with them up and down (PLATE IX). These bands are made up of the mats just described. On broad slopes whose surfaces are more or less convex, and on which the movement of materials downward is fairly uniform laterally, the mats are arranged transversely; but where the shale "flows" down gully-like depressions, with lines of greater or less mobility arranged down slope, the mats are on the areas of greatest stability and follow the lines of "flow." The mats are never anchored with equal success at every

point, so that they commonly move en masse under weights of shale dammed up above them, thus assuming the characteristic draped appearance. For the same reason the mats arranged parallel to the lines of movement are often discontinuous.

Causes for the movement of the shale other than gravity could not be accurately evaluated. Torrential rains in spring and summer could start some of it, as could also large amounts of meltwater at the time of the spring thaw. Or it might be due to alternate freezing and thawing of water among the stones early in the spring. The last is undoubtedly the principal cause on more nearly stabilized slopes where turf-banked terraces are also sometimes formed. It is of note that those seen on shale in the Brintnell Lake area were mostly on north-facing slopes. South- and west-facing shale slides on Red and Terrace Mountains were nearly barren, suggesting that the shale is there too mobile for the mat-forming plants to get a foothold. This suggests that local climatic factors are significant, resulting in more movement of snow in the spring, or more intense frost action after the snow has left.

*The vegetation of stone rings*

Well-defined stone rings were observed at Brintnell Lake in only one place. This was on a deposit of glacial till in the upper valley of Frost Creek, at an altitude of about 4500 feet (PLATE VI). The area where they were found is wet and springy, with small pools of water here and there. The rings vary in size from a few inches to about 6 feet, the larger ones bordered by till boulders as much as 3 feet in diameter.

The movement of materials by frost is so active that the stone rings are nearly devoid of vegetation except for crustose lichens on the larger boulders A single species of vascular plant was growing sporadically in the stirred soil of the rings, *Saxifraga Lyallii*. Curiously enough, this species was found nowhere else in the region. The area of the rings is well within the subalpine scrub zone, as it is developed in the valley of Frost Creek, and the characteristic plants of this zone encroach upon the outer rings and push into the more stable portions around the large boulders.

The production of stone rings and stripes appears to be much more active on the limestone mountains described by Porsild along the Canol Road (1945, p. 5). He states, "Everywhere on sloping ground solifluction and live stone creeps can be observed and on level ground polygon formation is active. Outcrops of rock everywhere show evidence of rapid weathering by frost action." Porsild gives no detailed studies of the relation of plant growth to these phenomena, although some of his notes on local habitats can be so interpreted (see below).

*Ledge and crevice vegetation*

Outcrops of creviced ledges occur on all the mountain slopes. Composed as they are largely of shaly rocks, they are breaking up very rapidly under the influence of subaerial erosion and frost cleavage. As stated previously, most of the sedimentary rocks of the region dip sharply to the southward and southwestward. Consequently the largest areas of shale slide-rock are on the south- and west-facing slopes, while the most extensive cliff development is on the upper north-facing ones (PLATE X). The north slope of Red Mt., for instance,

is a series of precipitous cliffs some 200 feet high, at the foot of which is a talus accumulation that reaches down another 300 feet or so to a small stream. Still higher cliffs appear on the north side of Colonel Mountain toward the summit. Hogback ridges are everywhere broken by steep outcrops of bedrock.

Most of the flora of the ledges is scattered in crevices or in small accumulations of residual soil that have formed on cliffs. Occasionally one finds a high ledge that is fairly level, so that its residual soil stays in place and will retain some water. Here a turf develops, carpeted by meadow types of community like those already described. Such places are rare, however, and the association of plants is usually open. As on slide rock, it is nearly impossible to designate primary species. It might be proper to say that crustose lichens play this role, for they cover most of the bare rock. Among vascular plants, *Dryas integrifolia*, *Saxifraga tricuspidata*, *Salix glauca* var. *acutifolia*, and *Trisetum spicatum* var. *Maidenii* are probably the most common species in crevices and on dry ledges. The following is a list of species found on these sites:

*Cystopteris fragilis, Woodsia ilvensis, Juniperus communis* var. *montana, Calamagrostis purpurascens, Poa alpina, Poa glauca, Poa paucispicula, Trisetum spicatum* var. *Maidenii, Carex nardina* var. *Hepburnii, Luzula confusa, Luzula spicata, Salix glauca* var. *acutifolia, Arenaria Rossii, Arenaria sajanensis, Arenaria verna* var. *pubescens, Silene acaulis* var. *exscapa, Arabis lyrata* var. *kamchatica, Cardamine bellidifolia, Draba cinerea, Draba lanceolata, Draba nivalis* var. *elongata, Draba praealta, Saxifraga aizoides, Saxifraga nivalis, Saxifraga oppositifolia, Saxifraga tricuspidata, Dryas integrifolia, Potentilla emarginata, Potentilla nivea, Potentilla uniflora, Astragalus alpinus, Hedysarum Mackenzii, Oxytropis ixodes, Oxytropis Maydelliana, Oxytropis pygmaea, Gentiana propinqua, Aster sibiricus, Erigeron jucundus, Arnica Lessingii, Arnica Snyderi.*

It will be noted that this list has much in common with that for shale slide rock. The cliffs constitute an extremely xerophytic and physically hazardous habitat, perhaps a little more stable than some of the slides. As previously noted, talus made up of larger rock has an extremely poor flora which closely resembles that of ledges.

A phase of the Mackenzie Mountain alpine vegetation not seen in the Brintnell Lake area is described by Porsild (1945) on the "Plains of Abraham" along the Canol Road. This locality is between 70 and 80 miles west of Norman Wells, at an altitude of about 5700 feet. It is underlain by massive limestones which give a strongly calcicolous aspect to the flora. Porsild designates four more or less distinct habitats, "each conditioned largely by exposure to the prevailing wind, snowcover and soil."

The most stable of these habitats is on "level, sheltered flats, on gentle slopes and at the foot of slopes where small terraces form. . . ." Here are listed *Arctagrostis latifolia, Puccinellia Vahliana, Carex atrofusca, Carex membranacea, Kobresia simpliciuscula, Juncus triglumis, Juncus biglumis, Lloydia serotina, Tofieldia palustris, Arenaria humifusa, Arenaria Rossii, Thalictrum alpinum, Papaver Keelei, Braya humilis, Draba alpina* var. *nana, Saxifraga aizoides.*

"On coarse, unsorted, broken limestone rock of the windswept ridges and rocky summit," the following species are noted: *Carex misandra, Luzula nivalis, Salix arctica, Salix phlebophylla, Arenaria arctica, Papaver Keelei, Saxifraga oppositifolia, Dryas integrifolia.*

In masses of *Cassiope tetragona* on "small islands" on gentle slopes were found *Thalictrum alpinum, Eutrema Edwardsii, Parrya nudicaulis, Potentilla*

*biflora, Oxytropis Maydelliana, Oxytropis terrae-novae, Pedicularis capitata, Senecio atropurpureus.*

Very unstable limestone talus has scattered plants of *Carex nardina* var. *Hepburnii, Carex rupestris, Melanidion borealis, Potentilla uniflora.*

From Porsild's habitat notes on his collections it is possible to draw up a list of species for still another type. This corresponds to our damp or wet alpine meadows at Brintnell Lake, and is as follows: *Equisetum variegatum, Arctagrostis latifolia, Puccinellia Vahliana, Carex atrofusca, Carex membranacea, Carex scirpoidea, Kobresia simpliciuscula, Juncus biglumis, Juncus ?triglumis, Lloydia serotina, Tofieldia palustris, Salix arctica, Polygonum viviparum, Arenaria humifusa, Arenaria sajanensis, Thalictrum alpinum, Anemone parviflora, Braya ?humilis, Saxifraga Hirculus, Gentiana propinqua, Pedicularis sudetica, Erigeron unalaschkensis, Senecio resedifolius.*

### *Plants of ravines and gorges below timber line*

Rocky ravines and gorges near lake level have a flora drawn principally from the more xerophytic elements of the slope forests. It is unnecessary to list it in full. Nevertheless these situations harbor a few unique species which justify their special notice.

The rocky gorge of the stream which drains eastward from the lake has already been mentioned. The cliff-faces here have a rich cover of crustose lichens, while on the ledges are mats of moss and fruticose lichens in which are dwarf junipers and a few small white spruces and white birches. *Calamagrostis purpurascens* and *Poa glauca* are also common there.

Creeks that drain the north slope of Colonel Mt. have cut deep into the bedrock between the hogbacks, so that by climbing over the recently formed stony fans we could get into narrow gorges with precipitous and often overhanging cliffs on either side. Two of the new species described in this paper, *Poa Brintnellii* and *Lychnis brachycalyx,* were found in one of these gorges, as well as a species of saxifrage (*Saxifraga sibirica*) which proves to be an addition to the flora of the continent. These places are probably among the most difficult plant habitats which the region affords. They are subject to torrential floods, falling rock debris, rapid disintegration of the rock itself, and a growing season reduced to lowest terms. In many spots there is never any direct sunlight.

Ravines on south-facing slopes are in sharp contrast. Their streams are lined with tall willows, and the forest flora pushes into every crevice and soil pocket. On the other hand no plants of unusual geographic or taxonomic interest could be found in them.

### *Flood plain communities*

A striking vegetational feature of the Brintnell Lake area is on the flood plain of the glacial stream at the western end of the lake. The youngest of the stream deposits are mud flats formed of the light gray rock flour brought down from the glacier. This material is in the form of a small delta at the mouth of the creek. A short distance above the lake coarser materials, sand and gravel, occur as low plains and ridges. Most of the sand and gravel appears to be coming from small tributary streams which come off the nearby mountainsides at steep gradients and spread their loads on the plain. Occasional torrential floods in the main creek probably are effective in reworking the sand and gravel.

I have already described the principal forest types on the flood plain, a white spruce type and a muskeg forest. One of the few places at Brintnell Lake in which developmental sequences in vegetation can be postulated reasonably is on this flood plain, and stages leading to the forest types can be defined with fair precision. The following notes will be presented, therefore, in the order of a proposed scheme for the successional development of the forests.

The most recently formed mud flats at the mouth of the creek have a dense stand of *Eriophorum Scheuchzeri* and *Juncus castaneus* (PLATE XI). The two species are completely mixed, but are nearly alone in forming the rather close cover. When the *Eriophorum* is in fruit, its cottony heads turn the flats white and make a conspicuous feature of the landscape. Small pools cut off from the main lake in the formation of the delta are devoid of aquatic plants, but are usually surrounded by pure stands of *Equisetum palustre*. The latter species also appears to form a transition community between the *Eriophorum–Juncus* association and one of grasses.

On surfaces that are a little older, the principal species are *Calamagrostis canadensis* var. *Langsdorfi* and *Arctagrostis arundinacea*. *Arctagrostis* attains its greatest abundance in the transition areas from *Equisetum palustre*, while the *Calamagrostis* is thickest on the higher parts of the marsh and on low natural levees along the creek. *Equisetum palustre* remains common throughout the *Calamagrostis–Arctagrostis* stage. Other plants in this community are *Equisetum fluviatile*, *Poa pratensis*, *Stellaria borealis*, and occasional willows, *Salix commutata*.

On fairly well-drained sites the *Calamagrostis* gives way directly to a shrub border of species derived from the neighboring flood plain forests: *Alnus crispa*, *Rosa acicularis*, *Viburnum edule*, and *Ribes triste*. At the transition from *Calamagrostis* to shrubs are several species which are not found elsewhere in the area or have their greatest development here: *Heracleum lanatum*, *Geum macrophyllum* var. *perincisum*, and *Artemisia Tilesii*. Other common plants are *Agropyron trachycaulum* vars. *unilaterale* and *novae-angliae*. The shrubs pass directly into the white spruce woods.

Much of the shore at the western end of the lake, away from the new mud flats, is marsh. The principal species nearly everywhere is *Carex aquatilis*, though *Calamagrostis neglecta* and *C. canadensis* var. *robusta* are also common.

On poorly drained mud flats back of the shore, either the *Eriophorum–Juncus* or the *Carex aquatilis* shore community may develop into a distinctive association which seems to be a forerunner of the muskeg. This association occupies wide areas, and has the most complex flora to be found on the muds.

PRIMARY SPP.: *Equisetum variegatum*, mosses.

SECONDARY SPP.: *Selaginella selaginoides*, *Agropyron trachycaulum* var. *Langsdorfi*, *Agrostis scabra*, *Festuca altaica*, *Carex microglochin*, *Tofieldia palustris*, *Cypripedium passerinum*, *Habenaria hyperborea*, *Salix commutata*, *Salix reticulata*, *Alnus tenuifolia*, *Betula glandulosa*, *Anemone parviflora*, *Parnassia palustris* var. *neogaea*, *Dryas Drummondii*, *Dryas integrifolia*, *Hedysarum alpinum* var. *americanum*, *Pyrola asarifolia* var. *incarnata*, *Arctostaphylos rubra*, *Antennaria* sp.

The moss and the *Equisetum* form a close mat over most of the ground. The latter is so abundant that as one walks through it there is a continuous crackling sound from the breaking siliceous stems. The willows, alders, and dwarf birches are only occasional except at the landward margins of the community where they become primary and pass into the muskeg. *Dryas* is commonest

on the drier sites, especially where there is a gravel or sand plain nearby. Occasional small white spruces and balsam poplars also appear on dry sites.

The most xerophytic habitats in the valley west of the lake are the gravel and sand plains. For the most part they have open plant associations, with the following species involved:

*Agropyron latiglume, Festuca brachyphylla, Zygadenus elegans, Populus Tacamahacca, Arenaria dawsonensis, Draba praealta, Dryas Drummondii, Fragaria glauca, Gentiana propinqua, Campanula lasiocarpa, Aster sibiricus, Antennaria isolepis, Taraxacum alaskanum, Taraxacum lapponicum.*

Much of the sand and gravel is barren, with the above plants scattered here and there. Over large areas, however, *Dryas Drummondii* forms tight mats to the exclusion of nearly everything else. Next to the *Dryas, Aster sibiricus,* which also tends to form mats, is probably the commonest species. The stabilization of the soil by these mats, with the accumulation of some humus, appears to set the stage for *Populus Tacamahacca,* which comes up to form a scrubby bush at the borders of the plains and finally grows into an open woods in which young white spruces come up. All stages in the transition to spruce through a stand of balsam poplar can be seen on the gravel plains and on the gravel fans from which they came. Similar transition woods are to be seen in reduced form on nearly all the gravel fans around the lake.

TABLE 3 gives a tentative outline for the course of these flood plain successions.

TABLE 3.

PROVISIONAL SCHEME OF PLANT SUCCESSIONS ON FLOOD PLAIN DEPOSITS AT WEST END OF BRINTNELL LAKE

| | | |
|---|---|---|
| *Picea glauca* | *Picea mariana–Ledum–Sphagnum* (muskeg) | *Picea glauca* |
| Shrubs | Shrubs | *Populus Tacamahacca* |
| *Calamagrostis canadensis* var. | *Equisetum variegatum* | *Dryas Drummondii* |
| *Equisetum palustre* | *Carex aquatilis* | Open herbaceous association |
| *Eriophorum–Juncus* | | |
| Newly formed mud flats | Marshy shores | Sand and gravel plains and bars |

## PLANT COMMUNITIES ALONG THE CANOL ROAD

Mr. A. E. Porsild has published (1945) excellent descriptions of vegetation types which he saw along the Canol Road between Macmillan Pass and Norman Wells. It is unnecessary to transcribe his notes here, but a brief guide to them

will facilitate comparison with those made by our party. A few references have already been made to them. Page citations refer to his paper:

Mackenzie valley forests were described in the area between Norman Wells and the lower Carcajou River (pp. 3–4), while muskegs and lower slope muskeg forests were noted near the crossing of Little Keele River about 50 miles west of Norman Wells (pp. 4–5). Higher slope and timber line forests and those of gravel plains along the streams are noted briefly along the upper Carcajou River and along Bolstead Creek (pp. 7–8), and again in the valley of the Twitya River (p. 8).

Alpine communities are described in some detail on the "Plains of Abraham," between 70 and 80 miles west of Norman Wells and at an altitude of about 5700 feet (pp. 5–7).

Further notes on alpine vegetation are given for Macmillan Pass (pp. 10–12), along with a few comments on the geographic affinities of the flora in this pass. Porsild points out that Macmillan Pass appears to mark a well-defined floristic boundary between the eastern and western slopes of the Mackenzie Mountains.

Frost action phenomena such as stone rings are described on the Plains of Abraham (pp. 5–7), and peculiar frost mounds in peat, known as "pingoes," were seen at Macmillan Pass (pp. 10–11).

## GEOGRAPHIC AFFINITIES OF THE VEGETATION OF SOUTHWESTERN MACKENZIE

### Introductory

Thus far I have attempted only to achieve botanical descriptions of some landscapes in southwestern Mackenzie. The geographic breadth of these descriptions and the amount of detail in them are extremely limited; but there are enough, I believe, to bring out the more important phytogeographic patterns in the area as a whole. An intriguing aspect of the vegetation is that of its developmental history, which, if it can be learned, will throw a great deal of light upon present trends of change and the causes for present distribution. Some evidence with which to reconstruct this history is to be found in the existing distribution and floristic content of plant communities, and in the geographic affinities both of the species and of the communities.

A complete analysis of geographic relationships would require a far more extensive knowledge of the plant life of all of southwestern Mackenzie than now exists. Lacking such extensive detailed knowledge, it seems best to select for study the areas for which we have the most complete information. The region of Brintnell Lake is outstanding in this respect, though it is small and not thoroughly representative of the Mackenzie Mountains. For the plateaus and lowlands east of the mountains our floristic knowledge is far from complete, but enough is known about their forest types to justify proposing the general geographic relationships of these types to other forests of the northwest.

Such conclusions as I have reached regarding the origin and history of the vegetation of this region, therefore, are based largely upon interpretations of the flora of the Brintnell Lake area, and of the plant communities both at Brintnell Lake and in the lowlands east of the mountains. Before setting down these interpretations it is necessary to present some analyses of the geographic patterns that are available.

## Geographic Relationships of the Forests of Southwestern Mackenzie

The upland forest of white spruce, jack pine, aspen, and balsam poplar, with its accompanying muskegs, is probably the most widespread timber type in southwestern Mackenzie east of the mountains. It was noted by Whittaker (1923) between the Mackenzie and the Horn Mountains, by Williams (1922) between Simpson and Wrigley, by Whittaker in the region south of the upper Mackenzie, and by McConnell (1891) along the lower Liard. It is characteristic of the uplands of the Wood Buffalo Park (Raup, 1935). Porsild (1945) has some brief notes on the region between Norman Wells and the Carcajou River which suggest that aspen, poplar, and pine are not so abundant there or have dropped out, and that white spruce and white birch are the principal forest trees on the uplands. A similar transition must occur on the eastern slopes of the Mackenzie Mountains west of Simpson and in the South Nahanni River valley. The northwestern limit of the jack pine in the Mackenzie valley is probably somewhere between Simpson and Norman. Preble (1908) placed it at about lat. 64° 30′.

Upland forests closely resembling those along the upper Mackenzie are widespread in the upper Liard basin (Raup, 1945), but here the lodgepole pine replaces the jack pine and there is very little balsam poplar in the burn successions. The transition from lodgepole to jack pine presumably is in the Liard gap and on the slopes of the northern Rocky Mountains (McConnell, 1891), and it is supposed that the two species overlap there (Halliday and Brown, 1943).

All of the forests along the upper Mackenzie and lower Liard Rivers are placed by Halliday (1937) in his "Mackenzie Lowland Section." In his discussion of this section, however, he makes no subdivision of it into flood plain and upland types such as appears to be necessary in this region. He sets a northern boundary for his "Mixedwood Section" approximately at the northern margin of the Alberta Plateau southwest of Great Slave Lake and south of the Mackenzie and Liard Rivers. The northwestern phase of the Mixedwood as Halliday describes it scarcely can be distinguished from some phases of his Mackenzie Lowland forest. It now seems more logical to redefine the Mackenzie Lowland Section so that it includes only flood plain types, composed principally of white spruce and balsam poplar. Upland types in the upper Mackenzie and lower Liard country could then be considered representatives of the far-northwestern expression of Halliday's Mixedwood, in which white spruce, aspen, jack pine, and balsam poplar are the most prominent trees, and in which there is some admixture of white birch.

This proposal necessitates greatly narrowing the area of the Mackenzie Lowland type, confining it to recent flood plain deposits along the rivers. The Mixedwood should then be extended northward in the Mackenzie valley, possibly to a limit that could be marked by the extent of the jack pine as an important tree. The eastward range of the Mixedwood, between the upper Mackenzie and the Laurentian Plateau, is as yet unknown.

At Brintnell Lake the lower slope forests of white spruce and white birch without pine bear a resemblance to those described by Porsild (1945) in the Mackenzie valley between Norman Wells and the Carcajou River. These appear to be beyond the northern limit of the spruce-pine-aspen-poplar type of the upper Mackenzie, and it has already been suggested that a similar change in composition must occur on the lower eastern slopes of the mountains. The

white spruce–white birch forest has no designation in Halliday's classification for Mackenzie basin types. The nearest approach to it is his "Yukon Section" as it was described in 1937 (p. 23). He extends this section eastward in the upper Porcupine River region approximately to the height of land west of McPherson, but it is possible that it should reach also into the lower Mackenzie country.

Whether or not Halliday's "Upper Liard Section" extends eastward to the South Nahanni River valley is yet unconfirmed. It has been so designated on a map of the Alaska Highway area (Raup, 1945). The Upper Liard and Mixedwood Sections are in reality quite similar in general appearance, structure, and flora. The principal difference by which they can be separated is the presence of lodgepole pine in the former and jack pine in the latter. On this criterion the eastern extent of the Upper Liard Section in our region is to be determined by the limits of the lodgepole pine in the Mackenzie Mountains, and the two sections probably overlap in the Liard Gap. Pines are known to be abundant in the region of Clark, McMillan, and Landing Lakes, in the Mackenzie Mountains southwest of Brintnell Lake. They were described to me by Mr. William Clark of Fort Simpson, and they appear in various places on the aerial photographs. It is presumed that they are lodgepole pines, although this is yet to be verified.

The forests of black spruce on the steep north-facing slopes at Brintnell Lake are likewise difficult to place in Halliday's classification. A somewhat similar type is of wide occurrence in the Rocky Mountains of northern British Columbia; but there it usually contains lodgepole pine and some white spruce and has been placed tentatively in a phase of Halliday's "Foothills Section" (Raup, 1945).

## Geographic Relationships of Species in the Brintnell Lake Region

Of the 283 species and varieties of vascular plants collected at Brintnell Lake, I have mapped 271. When the maps of range limits are superposed it becomes possible to designate a number of rather well-defined patterns. The actual number of these patterns depends of course upon the degree of refinement that enters into the selection of criteria. Needless to say, the scanty existing knowledge of geographic factors in boreal America makes it impossible to carry the refinement very far. Comparison of the maps soon brings out, however, two phytogeographic transition zones which appear to overshadow any others that appear. These are the arctic timber line, and the coastal mountains of southeastern Alaska, British Columbia, and western Washington. Some indication of the significance of these "boundaries" may be had from the following figures. Of the species considered in the maps 199 approach or cross the arctic timber line, and 164 of them are either stopped by it or cross it to a limited distance. Nearly all (283) of the Brintnell Lake plants extend *to* the western coastal mountains or forests, but about 196 of them avoid all or part of these habitats. In view of the obvious phytogeographic importance of the coast range and the arctic timber line, I have drawn up a tentative classification of range patterns based in large part upon the plants' behavior with relation to them. A third geographic boundary is not so well defined in all cases, but is sufficiently clear to necessitate recognition. This is marked by the eastern ranges of the Cordillera. About 25% of the Brintnell Lake flora does not extend east of the

Rocky Mountains, or has limited extensions into the northern great plain of the continent.

About 4.2% of the flora at Brintnell Lake (12 spp. and vars.) is composed of plants described as new in this paper, recently described from the lower Mackenzie district, or known in North America from this single area. Tentative ranges can be drawn for a few of these, but so little has been discovered about them that I have preferred to keep them in a separate category, and I have not included maps of them. They are as follows:

*Picea glauca* var. *Porsildii, Poa Brintnellii, Carex Soperi, Salix Barrattiana* var. *marcescens, Salix Bebbiana* var. *depilis, Salix glauca* var. *perstipula, Lychnis brachycalyx, Saxifraga sibirica, Rosa acicularis* var. *cucurbiformis, Arnica alpina, Arnica Snyderi, Antennaria* sp.

At the other extreme in range extension are three cosmopolitan species: *Cystopteris fragilis, Equisetum arvense,* and *Carex aquatilis* s. l. These are among the most wide-ranging plants in boreal America, and the first two are cosmopolitan throughout much of the world. In Canada and Alaska they thrive in nearly all parts of the arctic, alpine, and forest regions, without regard to boundaries that are limiting to most other plants. Of the three, *Equisetum arvense* seems to have the most varied stations. *Cystopteris fragilis* for some reason has not been collected on the arctic coast of Alaska, the southwest coast of Hudson Bay, the Richmond Gulf area on the east coast of Hudson Bay, or in the Hamilton Inlet region of Labrador. *Carex aquatilis* is known on the British Columbia coast only on Vancouver Island, and should perhaps be included with reservation among the cosmopolitan species.

The remaining 268 species and varieties can be arranged in five general categories: (1) species whose principal areas are in the region of the Canadian coniferous forest, and whose ranges are wide in this region, extending for the most part all the way across the continent; (2) arctic or arctic-alpine wide-ranging species with ranges concentrated north of the arctic timber line, or in both the arctic lowland and in the cordilleran alpine areas; (3) an intermediate group of wide-ranging subarctic species which cannot be placed with either of the above, but which appear to have their greatest concentration on or near the arctic timber line; (4) a group of Alaskan-cordilleran species which have only limited extensions east of the Rocky and Mackenzie Mountains, and most of which are arctic-alpine in general affinities; (5) a cordilleran group, most of which are alpine but not arctic, and whose ranges are concentrated in the Rocky Mountains and coast ranges. Further subdivisions of these five categories can be made by noting first the actual relation of the wider ranges to the arctic timber line, and second the relation of the ranges to the western coastal mountains or the Pacific slope forests. The following discussion will follow the above outline.

In order to compare the range maps in PLATES XIII–XXXVII more easily I have drawn lines connecting marginal stations in such a way as to outline the limits to which the various species are now known to extend. For common, much collected plants this can be done without difficulty, but in cases of rare or poorly collected species the outlines of geographic limits must be regarded as tentative. The most difficult cases are those with stations separated by hundreds of miles. Here it is often impossible to decide whether to consider the ranges as continuous or disjunct. Of the ranges mapped in this study I have designated only nine as being discontinuous, although it is possible that a few

others might be included. In defense of my tendency to reduce the number of disjunct ranges as much as possible I can only say that one of the results of the collecting and exploration in arctic and subarctic America during the past twenty years has been to fill in and make continuous many ranges that were formerly thought to have separate eastern and western components.

### *Wide-ranging forest species*

The most extensive plant ranges in Canada and Alaska, with the exception of the three cosmopolitans already mentioned, are exhibited by a small group of about 19 species. These plants do not stop at the arctic timber line, but reach far out into the tundra, particularly in the eastern arctic. Most of them are spread throughout the timbered parts of Alaska. Eight of them (*Fig. 4-a*) have the widest ranges because they also enter the forests of the Pacific slope from southern Alaska to western Washington:

*Equisetum scirpoides, Poa pratensis* s. l., *Corallorrhiza trifida, Alnus crispa* s. l., *Rubus Chamaemorus, Epilobium angustifolium* s. l., *Pyrola secunda, Ledum groenlandicum.*

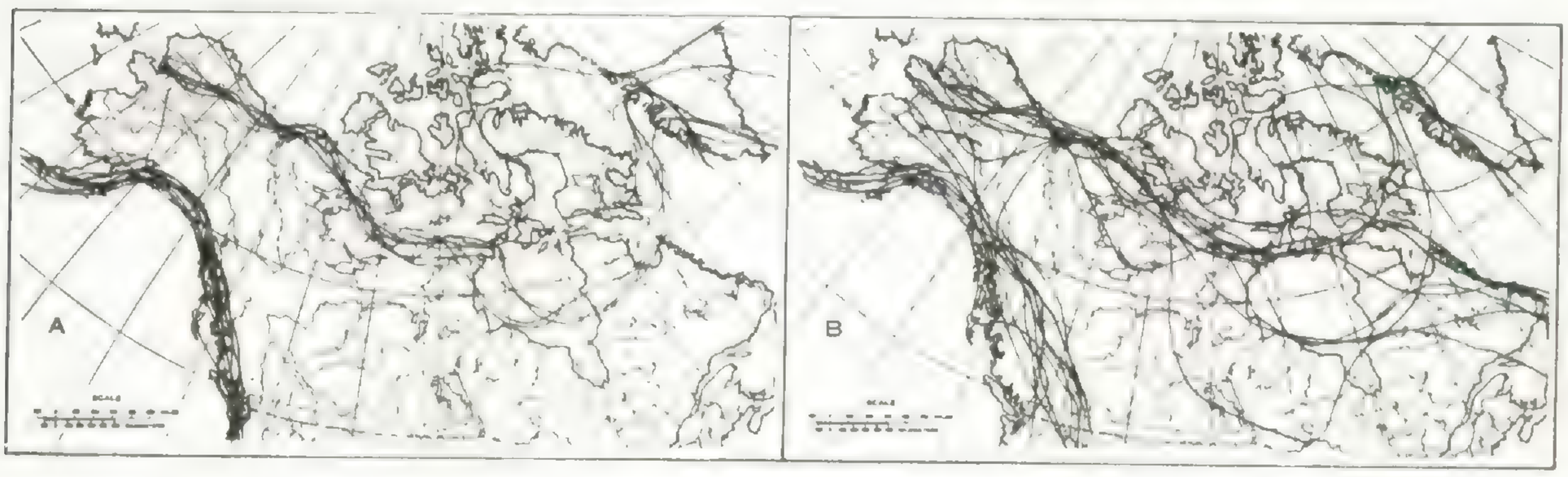


FIG. 4. Wide-ranging forest species extending north of the arctic timber line.

The other 11 species either avoid the coastal forests altogether, or enter them only in southern Alaska or Washington. Thus they are more strictly continental in the far west (*Fig. 4-b*):

*Calamagrostis neglecta, Carex vaginata, Habenaria obtusata, Salix planifolia, Betula glandulosa, Ranunculus Gmelini* var. *Purshii, Ranunculus lapponicus, Draba lanceolata, Potentilla fruticosa, Hedysarum alpinum* var. *americanum, Vaccinium Vitis-Idaea* var. *minus.*

The remainder of the widespread forest species are more rigorously limited by the timber line, though some of them occur far north on the Labrador coasts, southern Baffin Island, or in Greenland. There are 80 of them, divisible into four groups on the basis of their geographic relation to the Pacific slope forests. The first of these groups (*Fig. 5-a*) contains 30 species that appear in the coastal forests both in southern Alaska and in British Columbia and western Washington. Several of them, perhaps half a dozen, do not appear to reach the western coast of Alaska.

*Dryopteris Linnaeana, Equisetum fluviatile, Equisetum palustre, Lycopodium annotinum* s. l., *Selaginella selaginoides, Juniperus communis* var. *montana, Agrostis scabra, Poa nemoralis, Carex leptalea, Carex canescens, Carex Garberi* s. l., *Juncus balticus* s. l., *Smilacina stellata, Habenaria hyperborea, Salix Bebbiana, Arenaria lateriflora, Stellaria calycantha* s. l., *Actaea rubra, Ribes lacustre, Ribes triste, Shepherdia canadensis, Cornus canadensis, Cornus stolonifera, Moneses uniflora, Pyrola asarifolia* var. *incarnata, Pyrola*

*minor, Heracleum lanatum, Arctostaphylos Uva-ursi* (incl. var. *coactilis*), *Linnaea borealis* s. l., *Viburnum edule.*

The second group, of 13 species (*Fig. 5-b*), occurs in some of the coastal forests of southeastern Alaska, but becomes more continental in British Columbia and Washington. A few of them, probably not more than four, fail to reach the western Alaskan coast.

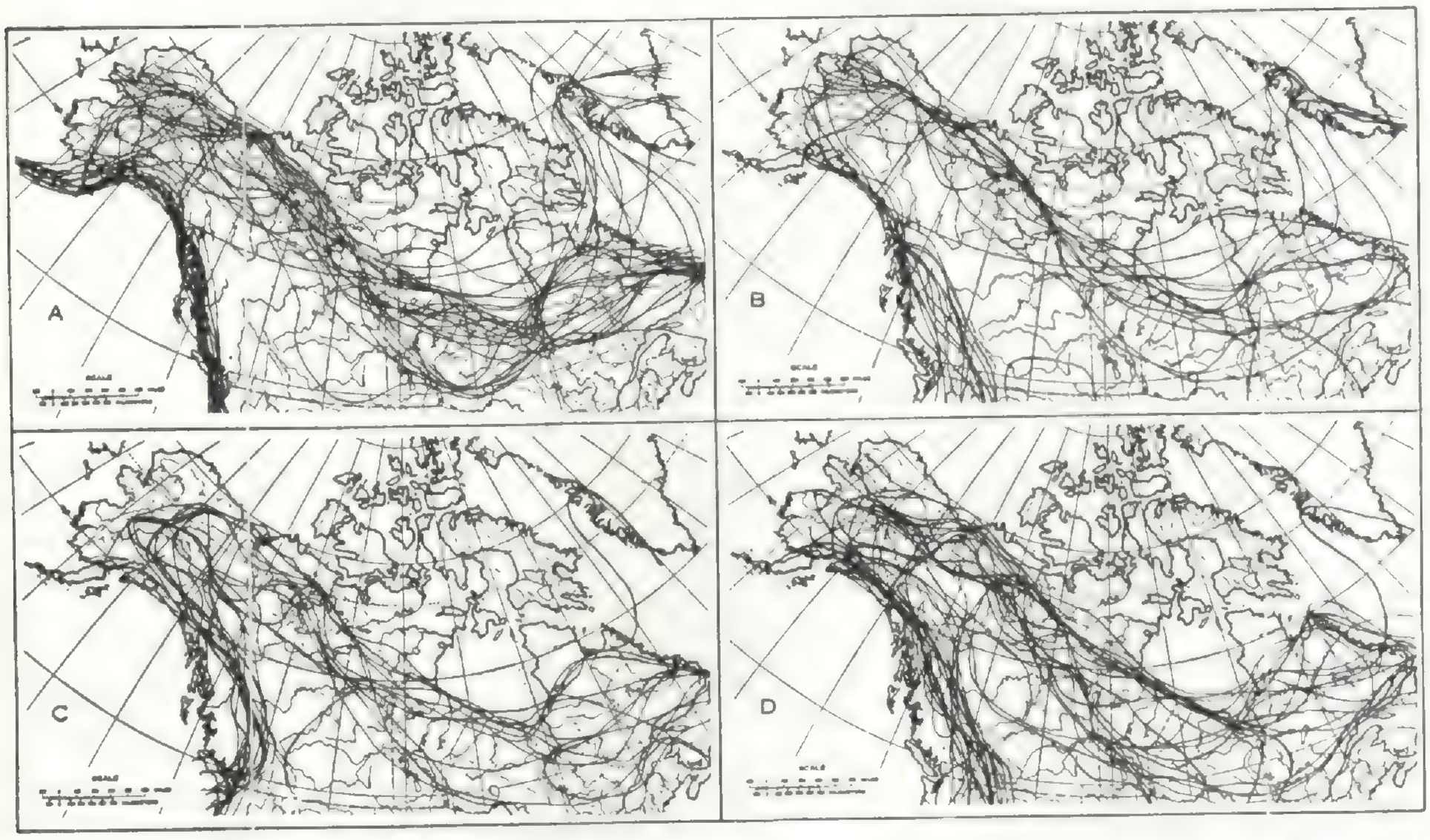


FIG. 5. Wide-ranging forest species whose northern limits are at or near the arctic timber line.

*Equisetum sylvaticum* s. l., *Lycopodium clavatum* var. *monostachyon, Lycopodium complanatum* s. l., *Carex gynocrates, Eriophorum brachyantherum, Cypripedium passerinum, Populus Tacamahacca, Populus tremuloides, Geocaulon lividum, Parnassia palustris* var. *neogaea, Ribes hudsonianum, Dryas Drummondii, Rosa acicularis* s. l.

A third group of 14 species (*Fig. 5-c*) is still more continental in range, reaching the coast timber only in southeastern British Columbia and western Washington. They avoid the wet slope forests of southern Alaska, and none of them extends to the western coasts of Alaska. Four of these plants seem to have disjunct ranges: *Arctostaphylos Uva-ursi* var. *adenotricha, Betula papyrifera* var. *commutata, Arabis Holboellii, Antennaria subvicosa.* I have included them here because a hypothetical joining of their parts would result in ranges similar to the others in *Fig. 5-c.*

*Carex aurea, Betula papyrifera* var. *commutata, Arenaria dawsonensis, Arabis Drummondii* s. l., *Arabis Holboellii, Geum macrophyllum* var. *perincisum, Potentilla norvegica, Pyrola virens, Arctostaphylos Uva-ursi* var. *adenotricha, Erigeron angulosus* var. *kamtschaticus, Erigeron elatus, Antennaria subviscosa, Senecio indecorus, Senecio pauperculus.*

The fourth, and almost strictly continental, group contains 23 species (*Fig. 5-d*). With one or two possible exceptions these plants avoid the Pacific slope forests entirely, and all but five of them fail to reach the west coasts of Alaska. A few are even more restricted and do not extend west of the northern Rocky Mountains.

*Picea glauca* s. l., *Picea mariana, Agropyron trachycaulum* var. *novae-angliae, Agropyron trachycaulum* var. *unilaterale, Calamagrostis canadensis* var. *robusta, Carex concinna, Carex diandra, Carex media, Goodyera repens* s. l., *Listera borealis, Salix myrtillifolia, Alnus tenuifolia, Betula occidentalis, Aquilegia brevistyla, Rorippa islandica* var. *microcarpa, Ribes glandulosum, Ribes oxyacanthoides, Amelanchier florida* (incl. *A. humilis*), *Fragaria glauca, Rubus acaulis, Rubus strigosus, Mertensia paniculata, Valeriana septentrionalis.*

## *Wide-ranging arctic-alpine plants*

There are 66 wide-ranging arctic-alpine plants in the Brintnell Lake flora. As among the forest species, one can first divide them into two groups according to their actual relation to the arctic timber line. In spite of the fact that the principal ranges of nearly all of them extend throughout much of the arctic archipelago, 26 of them are commonly found far south of the arctic limit of trees (*Fig. 6-a, b, c*). In so doing they achieve the most extensive ranges of all our arctic-alpine plants and, as did the forest species that crossed the timber line, they approach a cosmopolitan distribution in Canada and Alaska.

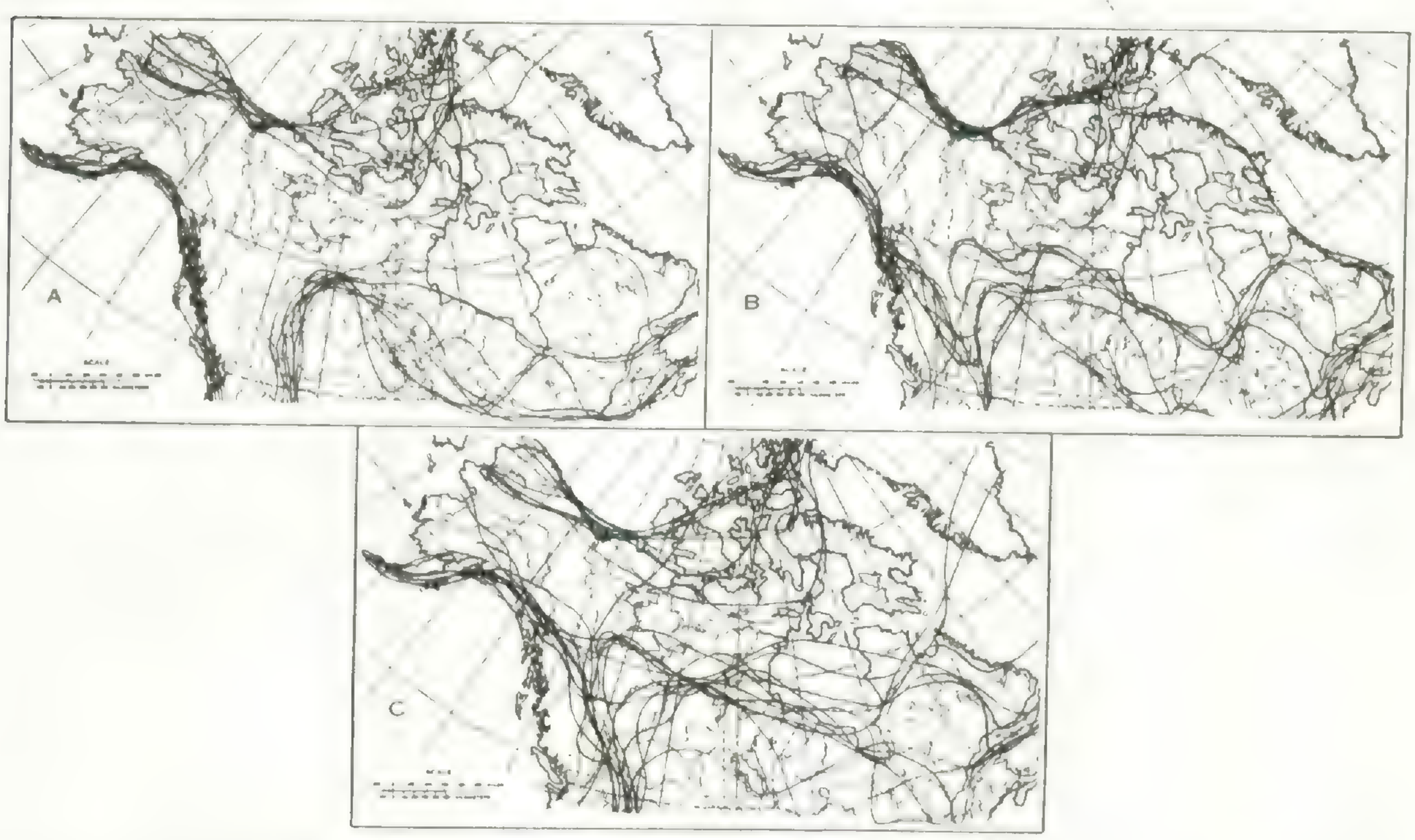


FIG. 6. Wide-ranging arctic and arctic-alpine species which extend far south of the arctic timber line.

The most extensive ranges are those of 7 species (*Fig. 6-a*) which occur not only on the Rocky and Mackenzie Mountains but also on the coastal ranges all the way from the Alaska Peninsula to Washington. They extend southward in the central plains at least as far as Lake Athabaska.

*Equisetum variegatum, Lycopodium Selago, Festuca brachyphylla, Poa alpina* s. l., *Carex scirpoidea, Salix arctica* s. l., *Empetrum nigrum.*

Another group, of 8 species, is predominantly continental south of the mountains in southeastern Alaska (*Fig. 6-b*). They occur on the coast and Alaska ranges of southern Yukon and Alaska, as well as on the mountains around the Lynn Canal, but in British Columbia and Alberta they are largely confined to the Rockies and Selkirks.

*Poa glauca, Trisetum spicatum* s. l., *Carex capillaris* s. l., *Juncus castaneus, Polygonum viviparum, Saxifraga tricuspidata, Dryas integrifolia, Astragalus alpinus.*

A third group of these extremely wide-ranging arctic-alpine plants contains 11 species (*Fig. 6-c*) and is almost completely continental in the west. Southeast of the Prince William Sound region of Alaska these plants are confined to the more northerly ranges of the coastal mountains, and to the Rockies and Selkirks. Only two of them come out to the coast in northwestern Washington.

*Dryopteris fragrans* s. str., *Calamagrostis purpurascens, Arenaria verna* var. *pubescens, Ranunculus hyperboreus, Cardamine pratensis* s. l., *Draba cinerea, Chrysosplenium tetrandrum, Saxifraga aizoides, Potentilla nivea* s. l., *Pyrola grandiflora* s. l., *Taraxacum lacerum.*

For the remaining 40 arctic-alpine plants the arctic timber line appears to be a more formidable barrier. They either stop at the timber line or come only a short distance south of it. Like the preceding group they can be arranged in three divisions depending upon whether they extend to the mountains of the Pacific coast.

First are 12 species of wide range on the coastal mountains (*Fig. 7-a*). One of these, *Dryas octopetala,* has a broken range. It is widespread in the Cordillera and reappears in northwestern Greenland.

*Agropyron latiglume, Poa arctica, Luzula spicata, Oxyria digyna, Silene acaulis* var. *exscapa, Cardamine bellidifolia, Saxifraga oppositifolia, Saxifraga rivularis, Dryas octopetala, Epilobium latifolium, Epilobium anagallidifolium, Erigeron unalaschkensis.*

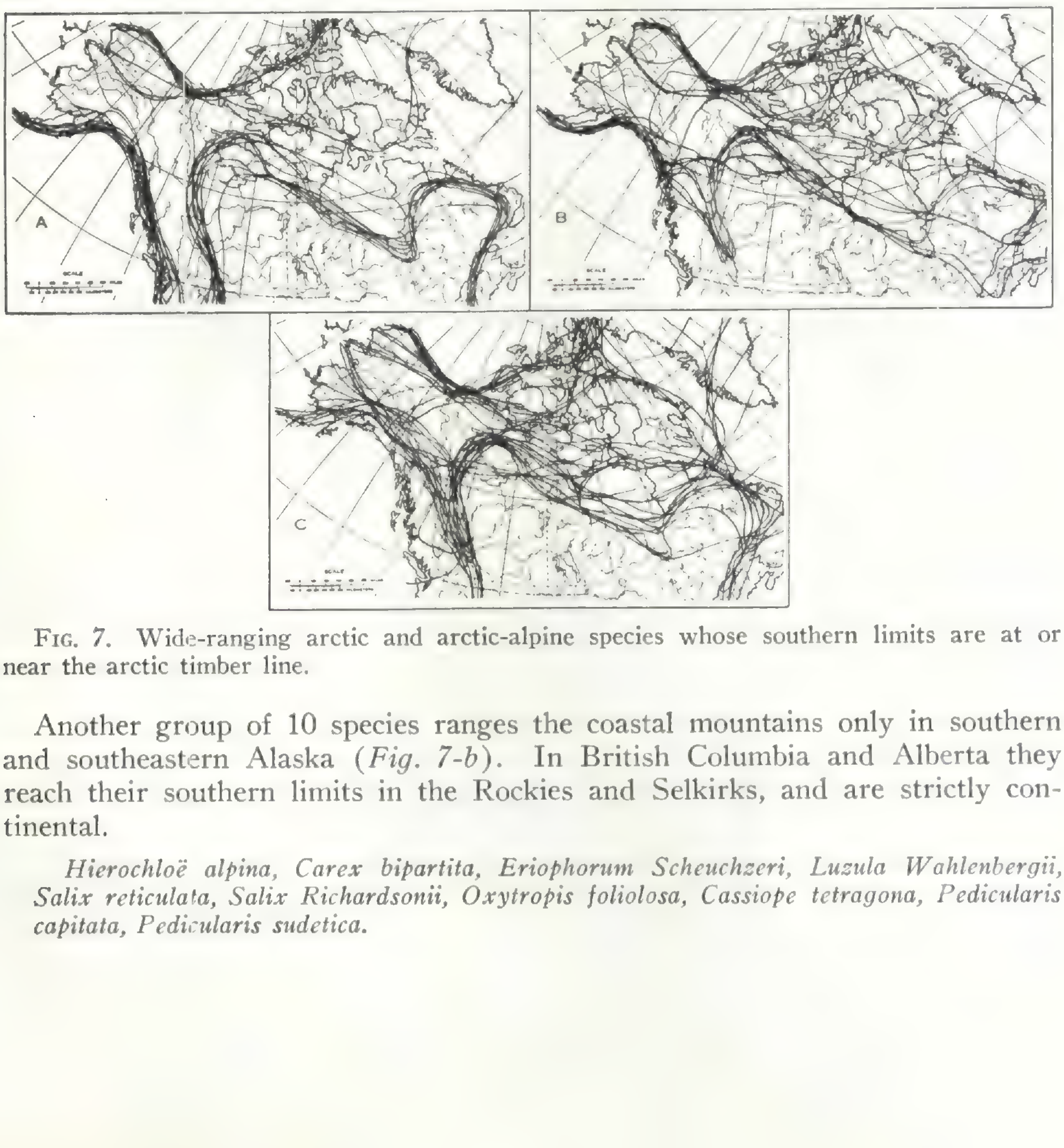


FIG. 7. Wide-ranging arctic and arctic-alpine species whose southern limits are at or near the arctic timber line.

Another group of 10 species ranges the coastal mountains only in southern and southeastern Alaska (*Fig. 7-b*). In British Columbia and Alberta they reach their southern limits in the Rockies and Selkirks, and are strictly continental.

*Hierochloë alpina, Carex bipartita, Eriophorum Scheuchzeri, Luzula Wahlenbergii, Salix reticulata, Salix Richardsonii, Oxytropis foliolosa, Cassiope tetragona, Pedicularis capitata, Pedicularis sudetica.*

Finally, a group of 18 arctic-alpine plants, with one exception in western Washington, avoid the coastal mountains entirely (*Fig. 7-c*).

*Calamagrostis lapponica* s. l., *Carex membranacea, Luzula confusa, Arenaria humifusa, Arenaria Rossii, Lychnis apetala, Stellaria longipes* var. *Edwardsii, Ranunculus nivalis, Draba fladnizensis* var. *heterotricha, Draba glabella, Saxifraga nivalis, Potentilla emarginata, Oxytropis Maydelliana, Epilobium davuricum, Vaccinium uliginosum* var. *alpinum, Pedicularis lanata, Erigeron eriocephalus, Crepis nana.*

Two features of the arctic-alpine plant ranges should be noted especially. Nearly all of them extend to the western Alaskan coasts, in contrast to the forest plants among which 39 do not accomplish this. Second, there are a few of the arctic plants, probably not more than 8, which do not occur in the Rocky Mountains at all, but find their southern limits in the Mackenzie Mountains and in southern Yukon or Alaska.

### *Plants of the timber line region*

There are 31 species which constitute something of an enigma in that, although they have wide subarctic ranges across most of the continent, they cannot properly be classed either with forest or arctic-alpine categories. They extend into the tundra, but avoid most of the high arctic regions. At the same time they are common to abundant in the northern part of the forest. They occupy a wide range of habitats, although none of them are characteristic of rich woods, and about two-thirds of them are perhaps most abundant in muskegs or wet tundra. Most of them appear in the northern Rockies, but two or three do not come south of the 60th parallel. All but two or three reach the western Alaskan coasts.

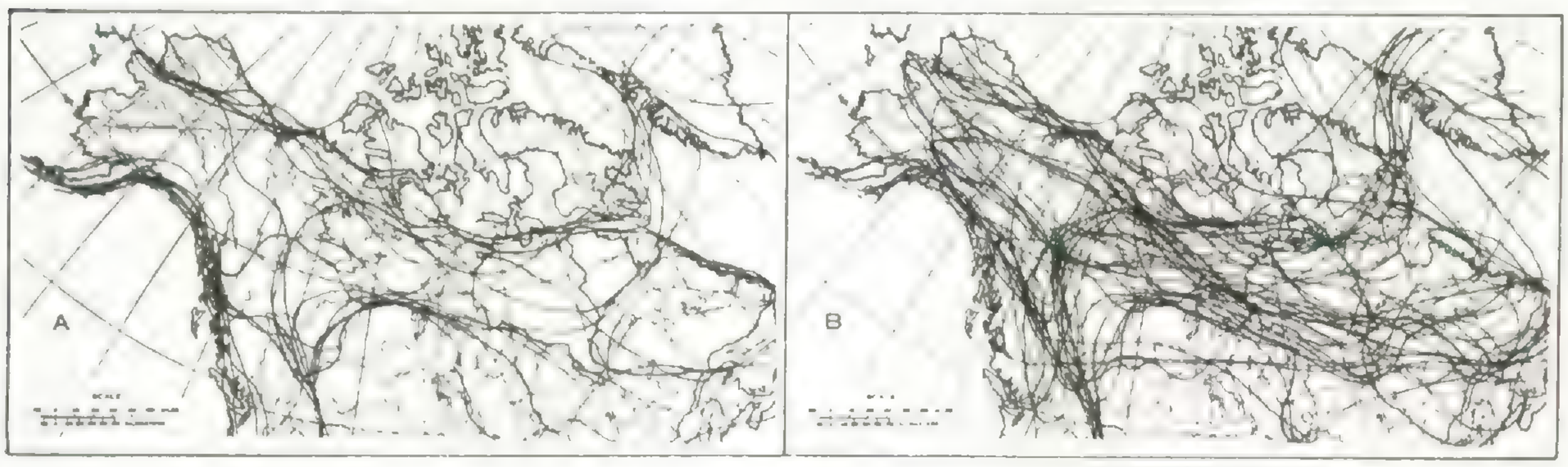


FIG. 8. "Timber-line species."

A glance at *Fig. 8-a* and *-b* will show that most of these "timber line" species are continental in the more southern parts of their ranges. I have arranged them in two groups, carrying out the plan used in other categories. The first group contains 10 species which occur in the coastal strip as far south as southeastern Alaska, while beyond that area all but 3 retreat inland (*Fig. 8-a*). One species of disjunct range is included here, *Lycopodium alpinum.*

*Woodsia ilvensis, Lycopodium alpinum, Calamagrostis canadensis* var. *Langsdorfi, Cerastium Beeringianum, Anemone parviflora, Anemone Richardsonii, Sibbaldia procumbens, Andromeda Polifolia, Vaccinium microcarpum, Vaccinium uliginosum.*

A second group, of 21 species, avoids the coastal strip except in southwestern British Columbia, where four of them come out to Vancouver Island (*Fig. 8-b*).

Three species with discontinuous ranges are in this group: *Sagina Linnaei, Epilobium lactiflorum, Oxytropis ixodes.*

*Carex deflexa, Carex microglochin, Tofieldia palustris, Salix glauca* s. l., *Arenaria sajanensis, Sagina Linnaei, Parnassia Kotzebuei, Hedysarum Mackenzii, Oxytropis hudsonica, Oxytropis ixodes, Epilobium lactiflorum, Cornus canadensis* f. *purpurascens, Arctostaphylos rubra, Gentiana propinqua, Pedicularis labradorica, Veronica alpina* var. *unalaschcensis, Pinguicula villosa, Solidago multiradiata, Antennaria isolepis, Taraxacum ceratophorum, Taraxacum lapponicum.*

### *Alaskan-cordilleran species*

An arrangement of Alaskan and cordilleran components of the Brintnell Lake flora on the basis of their relation to timber line proves to be impracticable. Of the 72 species counted in these categories, only ten can be regarded as forest plants, and most of these ten are likely to be found far above or beyond the timber line. All the others are plants commonly found in the alpine or western arctic tundra. However, as I have noted elsewhere in this paper, a great many alpine plants of the Mackenzie and northern Rocky Mountains are commonly found in the timbered areas at low levels. About half of the western alpine plants were found below timber line at Brintnell Lake, and no doubt further search would yield more of them. It is not possible, therefore, safely to classify them in relation to timber line.

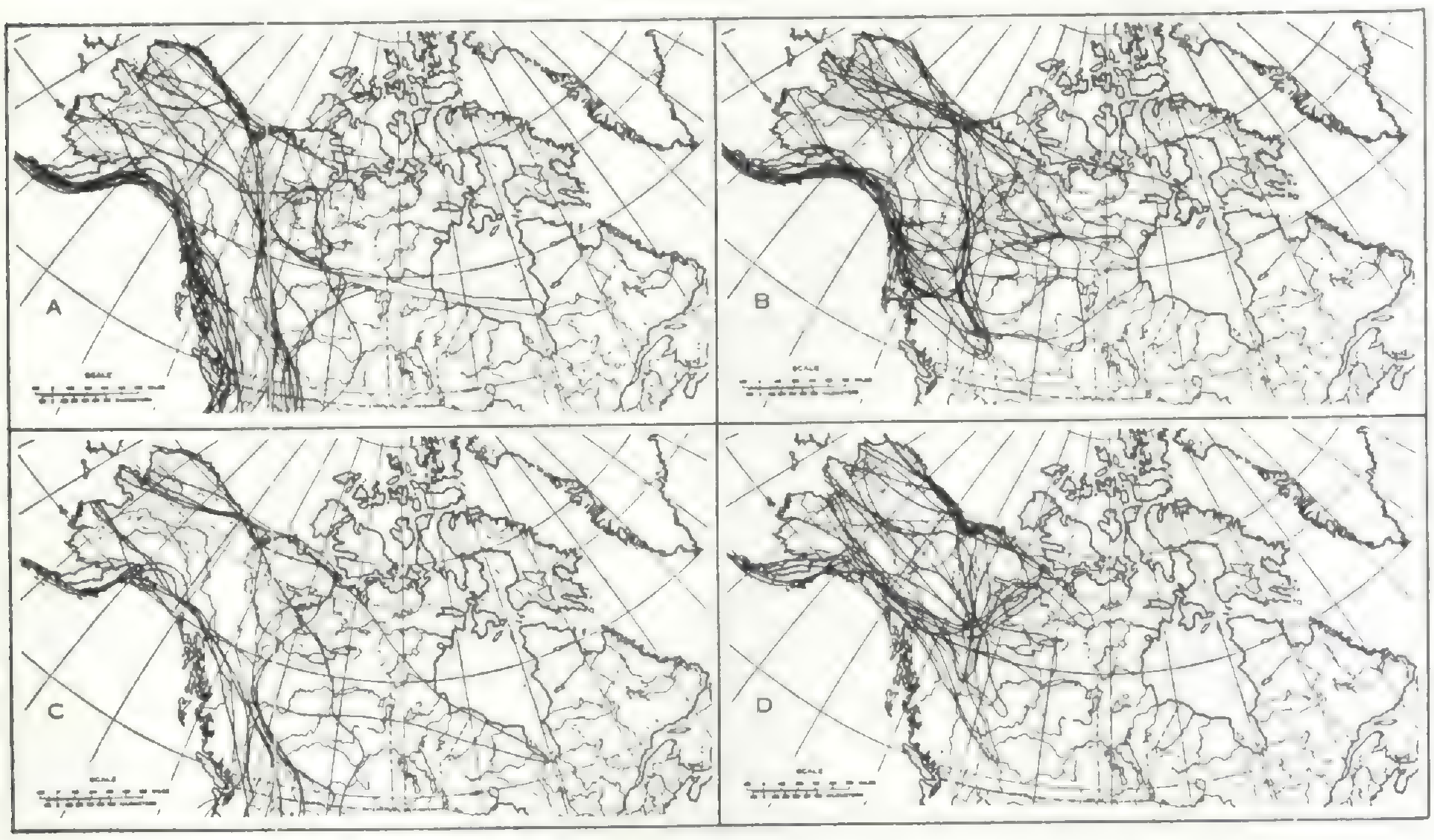


FIG. 9. Alaskan-cordilleran species.

I have arranged the 72 species in two main groups, the first of which ranges throughout central and western Alaska, many of them north to the arctic coast. Most of them come into the mountains farther south, so that I have called them the Alaskan-cordilleran group. There are 45 of these, 16 of which (*Fig. 9-a* and *-c*) range southward into the western United States. The whole group can be separated on the basis of its coastal extensions. First is a wide-ranging series of 11 species, all of which occur on the coastal mountains of southeastern Alaska, and many of them on the coast ranges farther south (*Fig. 9-a*).

*Carex physocarpa, Luzula arcuata, Lloydia serotina, Zygadenus elegans, Arabis lyrata* var. *kamchatica, Sedum roseum* var. *integrifolium, Viola epipsila, Gentiana glauca, Aster sibiricus, Artemisia arctica* s. l., *Petasites frigidus.*

Allied to these, but with their southern extensions terminating in Yukon or the Alberta and British Columbia Rockies, are 15 species, all of which are coastal in southern or southeastern Alaska (*Fig. 9-b*).

*Cryptogramma crispa* var. *sitchensis, Arctagrostis arundinacea, Festuca altaica, Poa paucispicula, Carex loliacea, Salix alaxensis* s. l., *Salix arbusculoides, Salix pulchra, Betula papyrifera* var. *humilis, Aconitum delphinifolium, Anemone narcissiflora, Saxifraga punctata* s. l., *Boschniakia rossica, Campanula lasiocarpa, Arnica Lessingii.*

Two groups are more strictly continental in the region southeast of Prince William Sound, although a couple of species appear at the coast in the Puget Sound area. Five species range southward into the United States (*Fig. 9-c*).

*Delphinium glaucum, Potentilla uniflora, Myosotis alpestris* s. l., *Artemisia Tilesii* s. l., *Senecio lugens.*

The remainder, 14 species, extend from Alaska to the northern Rocky Mountains, and avoid the coastal mountains except west of Prince William Sound (*Fig. 9-d*).

*Larix laricina* var. *alaskensis, Carex nesophila, Carex podocarpa, Corydalis pauciflora, Draba longipes, Saxifraga radiata, Astragalus frigidus* var. *littoralis, Lupinus arcticus, Oxytropis hyperborea, Oxytropis pygmaea, Gentiana arctophila, Polemonium acutiflorum, Antennaria monocephala, Taraxacum alaskanum.*

### *Cordilleran species*

The last category of ranges to be considered involves 27 plants that are more strictly cordilleran than any of the above. They do not reach the arctic coasts proper, either in Alaska or Mackenzie, and their eastward extensions into the northern plains are less numerous and less pronounced. All of them range southward into the western United States. They fall rather clearly into two groups: one with a strong coastal relationship and the other just as strongly continental.

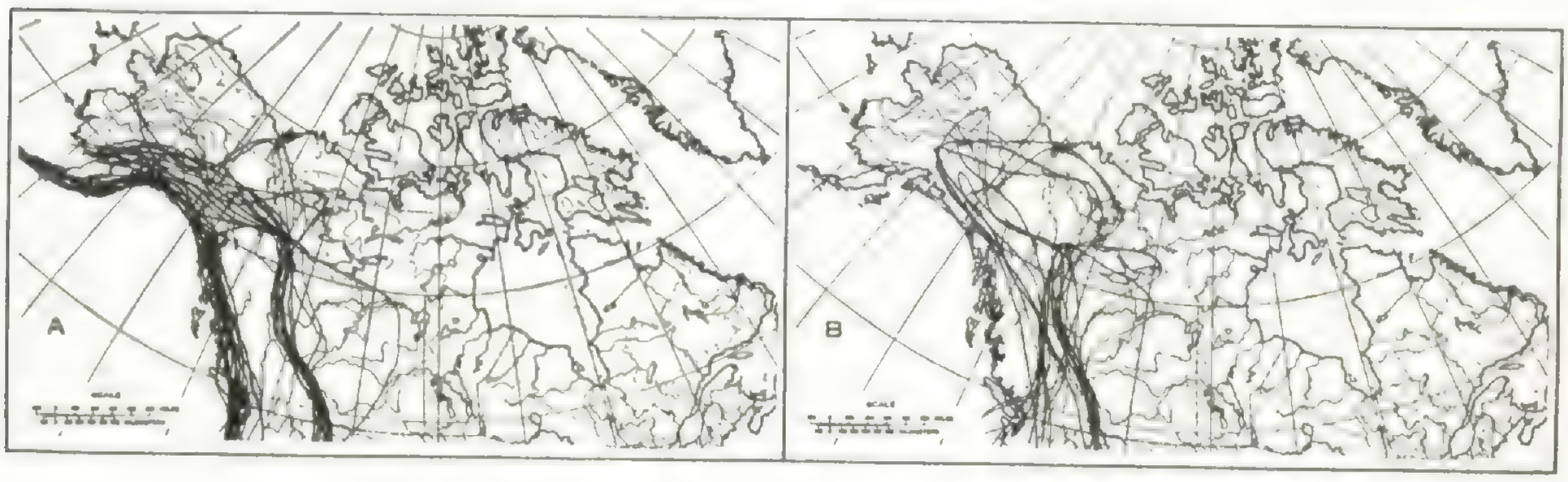


FIG. 10. Cordilleran species.

Sixteen of the 27 follow the coastal mountains from the Alaska Peninsula to western Washington, although a couple of them retreat inland a short distance in the latter region. They extend throughout the northern Rocky Mountains, but most of them are confined to the southern ranges of Alaska. None of them reach the lower Yukon valley (*Fig. 10-a*), although two have been found at the Mackenzie River delta. Our Mackenzie Mountain collections have constituted northeastern range extensions for most of these species.

*Abies lasiocarpa, Carex nardina* var. *Hepburnii, Carex phaeocephala, Carex pyrenaica, Juncus Drummondii, Salix Barclayi, Salix commutata, Salix Scouleriana* s. l., *Ranunculus Eschscholtzii, Draba nivalis* var. *elongata, Parnassia fimbriata, Saxifraga Lyallii, Hippuris montana, Phyllodoce glanduliflora, Senecio triangularis, Hieracium gracile.*

The other 11 cordilleran plants avoid the coastal strip except in the south, where four of them appear in the Puget Sound region. A few of them (4) reach central Alaska, and two are found at the Mackenzie delta (*Fig. 10-b*). This group contains the very few Rocky Mountain plants which have their known northern limits in the Mackenzie Mountains.

*Poa Buckleyana, Carex albo-nigra, Carex atrata* ssp. *atrosquama, Salix Barrattiana, Draba McCallae, Draba praealta, Potentilla diversifolia* s. l., *Erigeron jucundus, Antennaria media, Arnica mollis, Arnica alpina* ssp. *tomentosa.*

## *Discussion*

TABLE 4 gives a summary of the range patterns just described. Some generalizations from these figures will serve to bring out further the regional characteristics and affinities of the Brintnell Lake flora. Fully 70%, or about 199 of the species, have wide ranges across the continent, most of them extending

TABLE 4.

| | No. of spp. and vars. | Per cent |
|---|---|---|
| Endemics and plants of limited known range | 12 | 4.2 |
| Cosmopolitan in Canada and Alaska | 3 | 1.0 |
| Wide-ranging forest species | | |
| Reaching coasts of Alaska, B. C., and western Washington | 38 | 13.4 |
| Reaching coasts of southeastern Alaska | 13 | 4.6 |
| Avoiding coasts, southeastern Alaska to Washington | 48 | 17.0 |
| Wide-ranging arctic or arctic-alpine species | | |
| Reaching coastal mountains, Alaska to Washington | 19 | 6.7 |
| Reaching coastal mountains of southeastern Alaska | 18 | 6.4 |
| Avoiding coastal mountains, S. E. Alaska to Washington | 29 | 10.2 |
| Wide-ranging "timber-line" species | | |
| Reaching coast of S. E. Alaska | 10 | 3.5 |
| Avoiding coasts, S. E. Alaska to Washington | 21 | 7.4 |
| Alaskan-cordilleran species | | |
| Reaching coasts, Alaska to Washington | 11 | 3.9 |
| Reaching coasts of southern and southeastern Alaska | 15 | 5.3 |
| Avoiding coasts, S. E. Alaska to Washington | 19 | 6.7 |
| Cordilleran species | | |
| Reaching coasts, southern Alaska to Washington | 16 | 5.6 |
| Avoiding coasts, southern Alaska to Washington | 11 | 3.9 |
| Totals | 283 | 99.8 |

from Alaska to the Gulf of St. Lawrence. Approximately 25.4% are Alaskan or cordilleran, while the remaining 4.2% are endemic or local.

The wide-ranging plants fall into two main groups, arctic-alpine and forest species. In the first there are 66 species, while in the second there are 99. A third group of 31 species (10.9%) are intermediate between the first two,

and three (1%) are cosmopolitan. This is not a complete statement of the proportions of arctic-alpine and forest elements, however, because approximately 62 of the 72 Alaskan and cordilleran plants are of prevailingly alpine or arctic affinity and should be added to the wide-ranging ones. Thus the total of arctic, arctic-alpine, and alpine plants is about 128, or about 45% of the total vascular flora, and that of forest species is 109, or about 38% of the whole.

Although the flora as a whole is strongly continental in character, a great many of its species are able to live in the damp forests of the north Pacific slopes or on the coastal mountains. The range maps give a rough index to the degree of continentality which is achieved by the Brintnell Lake flora, a fact worthy of note. There are about 140 species (49.4%) which avoid the coastal forests and mountains completely or nearly so, and are the most rigorously continental plants in our flora so far as the west is concerned. Another 56 (19.8%) avoid the British Columbia and Washington coasts, but occur in southeastern Alaska. The remaining 87 (30.7%) inhabit, in addition to the continental ranges, the coastal strip from Alaska to Washington.

Another figure of some interest for evaluating the floristic affinities of our area is the number of plants that do not reach the western coasts of Alaska. There are approximately 86 of these, or about 30% of the flora.

TABLE 5 will summarize the above generalizations.

TABLE 5.

| | No. of spp. and vars. | Per cent |
|---|---|---|
| Endemics and plants of limited known range | 12 | 4.2 |
| Cosmopolitan species | 3 | 1.0 |
| Plants of wide range across the continent | 199 | 70.3 |
| Plants with ranges mainly in Alaska and the Cordillera | 72 | 25.4 |
| Plants of the forested country | 109 | 38.0 |
| Arctic, arctic-alpine, or alpine species | 128 | 45.0 |
| "Timber-line" ranges | 31 | 10.9 |
| Strictly continental with regard to S. E. Alaska, B. C., and Washington | 140 | 49.4 |
| Plants that avoid the coasts of B. C. and Washington, but occur in S. E. Alaska | 56 | 19.8 |
| Plants whose ranges extend into the coastal strip of S. E. Alaska, B. C., and Washington | 87 | 30.7 |
| Plants that do not reach the western coasts of Alaska | 86 | 30.0 |

## Alpine Plants below Timber Line

Among the 283 species and varieties of vascular plants found in the Brintnell Lake area it is possible to make the following subdivisions based upon their relation to timber lines.

| | | |
|---|---|---|
| Lower altitudinal limits in subalpine scrub | 62 | 21.9% |
| Confined to the subalpine scrub | 6 | 2.1% |
| Upper altitudinal limits in subalpine scrub | 131 | 46.3% |
| Widespread above and below timber line | 84 | 29.7% |

Of the plants confined to areas above timber line nearly all prove to have definitely arctic or alpine ranges in the boreal part of the continent. Most of them are but rarely found in the northern fringes of the forest. Of the 131 species not found above the subalpine scrub, however, about 20 also belong in the category of arctic-alpine species. These plants probably should be in the fourth group given above, and were not seen above timber line at Brintnell Lake because suitable habitats were not available in the areas observed by our party. Many of them are plants of wet mossy tundra which is rare or nonexistent on the dry alpine slopes around the lake. Two other species in the lower slope group also should not be considered characteristic. These are *Carex aquatilis* and *Carex capillaris,* both of which are "wides," almost universally distributed throughout the forest and the tundra. The total number of species that can be considered characteristic of the slopes and bottoms below timber line is therefore reduced to 109.

It is of interest to examine further the ranges of the 84 species that appear to cross the timber line with impunity. Two of them are obviously wides: *Cystopteris fragilis* and *Equisetum arvense.* Another 20 can be classed as belonging to the boreal forest regions. They appear to reach their greatest concentration within the forest zone either in the west or extending across the continent. Thus they can be looked upon as invaders of the alpine areas from below. Needless to say, most of them are not found far above the subalpine scrub. They may be listed as follows: *Lycopodium complanatum, Juniperus communis* var. *montana, Zygadenus elegans, Betula glandulosa, Delphinium glaucum, Arabis lyrata* var. *kamchatica, Draba lanceolata, Dryas Drummondii, Potentilla fruticosa, Rosa acicularis, Hedysarum alpinum* var. *americanum, Shepherdia canadensis, Epilobium angustifolium, Pyrola asarifolia* var. *incarnata, Pyrola secunda, Ledum groenlandicum, Vaccinium Vitis-Idaea* var. *minus, Mertensia paniculata, Linnaea borealis* var. *americana, Aster sibiricus.*

Fifty species appear to be derived from the arctic and alpine elements of the flora: *Dryopteris fragrans, Equisetum variegatum, Agropyron latiglume, Arctagrostis arundinacea, Calamagrostis purpurascens, Festuca altaica, Festuca brachyphylla, Poa glauca, Poa alpina, Poa arctica, Poa paucispicula, Trisetum spicatum* var. *Maidenii, Carex atrata* ssp. *atrosquama, Carex pyrenaica, Carex scirpoidea, Luzula arcuata, Salix alaxensis, Salix glauca* var. *perstipula, Salix reticulata, Salix Richardsonii, Oxyria digyna, Polygonum viviparum, Arenaria verna* var. *pubescens, Silene acaulis* var. *exscapa, Stellaria longipes* var. *Edwardsii, Aconitum delphinifolium, Cardamine bellidifolia, Draba longipes, Draba McCallae, Draba praealta, Saxifraga aizoides, Saxifraga tricuspidata, Dryas integrifolia, Astragalus alpinus, Astragalus frigidus* var. *littoralis, Lupinus arcticus, Oxytropis hyperborea, Empetrum nigrum, Epilobium latifolium, Cassiope tetragona, Polemonium acutiflorum, Pedicularis capitata, Campanula lasiocarpa, Antennaria monocephala, Artemisia arctica, Arnica alpina, Arnica Snyderi, Senecio lugens, Crepis nana, Taraxacum alaskanum.*

Finally there are 12 species from the group that I have designated as "timber line species": *Carex deflexa, Tofieldia palustris, Anemone parviflora, Anemone Richardsonii, Parnassia Kotzebuei, Sibbaldia procumbens, Oxytropis ixodes, Hedysarum Mackenzii, Arctostaphylos rubra, Gentiana propinqua, Pedicularis labradorica, Solidago multiradiata.*

Five of the 6 plants confined to the scrub appear to be more nearly related to the arctic and alpine elements than to those of the forests. The sixth, *Cornus*

*canadensis* f. *purpurascens,* is merely a color form of the common bunchberry of the woods.

In the preceding analysis of floristic affinities, a division is made of all the flora of the Brintnell Lake area into three groups exclusive of local plants and "wides": plants of boreal forests, plants of arctic-alpine affinities, and a group of "timber line species." The total numbers in these categories are 109, 128, and 31, respectively. Of all the species of boreal forest affinities, therefore, 20, or about 18.3%, are able to extend their local ranges above timber line; and as previously noted most of them do not reach far above the scrub. On the other hand 50 species of arctic-alpine affinity, or about 39% of the total, are found both above and below timber line. Nearly all of them are found at lake level. If the 20 alpine forms found around the lake but not above timber were to be added to this group the percentage would be still greater, about 54.7%. As would be expected, the percentage among the "timber line" species is also relatively high: 38.7%.

It appears, therefore, that the timber line is a far more significant boundary for boreal forest plants than for arctic-alpine ones. There is the suggestion, further, that the forest is intrusive at Brintnell Lake, having invaded an alpine tundra whose remnants are still to be found at all levels in the vicinity.

Most of the alpine species at lake level are found immediately on the shores of the lake, either on the gravel beaches of the fans or in local muskeggy spots at or just above the level of the lake. These are the most rigorous, unstable habitats at the lower altitudes, due to stream erosion and deposition, wave action, ice push, and frost heaving. They are the areas which the slope and lowland forests have not yet been able to occupy, and they could well serve as relic areas for a tundra flora.

## Application of Hultén's Hypotheses to the Brintnell Lake Flora

The flora of the Mackenzie Mountains, so far as it is at present known, should be examined and studied in the light of Dr. Eric Hultén's thesis (1937) concerning the origin and dispersal of all arctic and boreal floras. The geographic position of the Mackenzie Mountains in northwestern America, their recent botanical exploration, the apparent partial isolation of their alpine flora during post-Glacial time, and the simplicity and apparently incipient endemism in their flora all suggest that this flora might be used as a test of Hultén's thesis. In the following discussions it must be borne constantly in mind that I am treating only one phase of the Mackenzie Mountain flora, that in the vicinity of Brintnell Lake. Mr. Porsild's collections of 1944 on the westerly slopes of the range show a much larger assemblage of plants, whose geographic affinities will have to be studied before a balance can be struck for the whole region.

It is unnecessary to review in detail all of the reasoning and implications of the theories advanced by Hultén, for this has already been done by several students (see Stebbins, 1942; Raup, 1941; Halliday & Brown, 1943; Cain, 1944). The following is a brief outline of the broader geographic aspects, with a few critical notes that have grown out of the present investigation.

In connection with his floristic studies of Kamtchatka and the Aleutian Islands Hultén mapped, sometimes in detail and sometimes by limits, the ranges of hundreds of arctic and boreal species. He organized this factual material on the basis of what he called "equiformal areas." That is, when large numbers of

ranges are superposed they fall into a group of patterns which are more or less clearly defined geographically, and "equiformal" within themselves. Each equiformal area shows a region of concentration in number of species, which is called its "centre." Since it is assumed that each species has acquired its present range by dispersal from a point of origin or survival, the regions of concentration within the equiformal areas are regarded as fundamental centers of origin for the various major elements in the flora; and the "equiformal areas" become "equiformal progressive areas" that are thought to indicate the general patterns of dispersal among the major elements. The species are termed "radiants" from the various "centra."

The geographic arrangement of centra as worked out by Hultén is as follows: They are ". . . in North-Eastern Siberia and in the Amur-Manchurian region. Another occurs in the Altai-Sajan region, sending out radiants towards the Arctic shore. A third centre is northern Japan, whence numerous plants radiate to the north and to the coast of the Asiatic Continent. A centre of great importance is the region around the northern part of the Bering Sea. It sends out progressive radiants reaching symmetrically as well to the west into arctic Asia and Europe as to the east to Eastern America, and also often extends arms along both the Asiatic and American Pacific coast. In America radiants proceed from the Yukon valley along the Arctic American coast, others centre around the Arctic Archipelago, and others again have the centre of their progressive figures in the State of Washington and radiate along the American coast or along the Rocky Mts. to Alaska. Of the plants discussed . . . no groups could be formed having their centres in northern Europe or western Siberia, or in North-Eastern America or in the country between Yukon Valley and the Great Lakes" (Hultén, 1937, p. 25).

Hultén immediately draws a correlation between the distribution of his centra and the distribution of ice during the Pleistocene. No centra could be found in areas that were covered by ice during the maximum advance of the glaciers; and the existing floras have all been derived from areas of refuge close to the ice. It is maintained, on genetical grounds, that the ability of the species to disperse themselves from their refugia has not been uniform. Those confined to small refugia, under difficult climatic conditions and in small populations, are considered to have been so depauperated of biotypes that they have been exceedingly slow to spread. Others had large areas and populations, either within the generally glaciated regions or south of the ice, so that they retained their inherent variability and aggressiveness and could quickly invade lands freed of ice.

It is thought that the "Linnaean species" of the present boreal flora originated in the last great interglacial or earlier, and that large numbers of them achieved wide dispersals during that time. Their present areas are looked upon as reductions from these wide ranges, with post-Glacial re-expansions that have been conditioned by the amount of depauperation suffered during the maximum ice advance.

If the general thesis outlined by Hultén is tenable, then the flora of the Mackenzie Mountains should show affinities with his various centra which, within the general limits of accessibility, are directly proportional to the size of the relic populations, and presumably inversely proportional to their degree of biotype depauperation.

Before proceeding with such an analysis of the Brintnell Lake flora it will be well to examine critically the disposition made by Hultén of certain species, and

to make some additions to his lists. It is impossible in the present study to make a complete critical revision of the equiformal progressive areas, for to do so would require the remapping of all the species' ranges. Only such notes will be presented as have appeared in the investigation of the Brintnell Lake plants.

Hultén's arrangement of equiformal areas is open to modification or criticism along three lines. First, it is possible to make additions to his lists, at least in the American boreal flora. The Brintnell Lake region is found to have approximately 45 species not discussed by him at all. When these are sorted into patterns they have a distribution among the equiformal areas, however, that makes no serious modification in the latter. Second, there are apparent gaps in the ranges of boreal American plants which are gaps in exploration rather than in the actual ranges. Lacunae in our knowledge of the more uniform floras of eastern glaciated regions are not so troublesome; but the gaps in northern British Columbia and Yukon are more serious, for the distribution of species into equiformal areas sometimes depends upon their behavior in this region. Some of Hultén's dispositions of species are therefore open to modification due to range extensions discovered since his study was made. Third, Hultén's original sorting of species among his equiformal areas can be questioned in many cases. This is particularly notable in his treatment of wide-ranging forms.

Although suggestions along these three lines will be made in the discussions that follow, it will be noted that only a few actual changes in Hultén's lists have been made, other than by the addition of species not treated by him. Such changes as may be made are in many cases matters of judgment, and even when all are taken together they probably will make no serious modification of the structure. For the purposes of the present paper therefore, and until the general level of definitiveness in the whole structure is raised, it has seemed best to leave many of the doubtful ranges where Hultén placed them.

### *Southern Beringia radiants*

Two groups of equiformal areas are centered in the Beringian region. First to be considered is in southern Beringia. It extends both east and west from the Aleutian chain—to Kamtchatka and the Kuriles on one hand and southward along the Pacific coast of America to the United States on the other. Hultén lists 77 species and varieties here, some of which are of wide range in the area, but many of which show discontinuous and widely separated stations. They are thought to have occupied small, isolated refugia during the Pleistocene, and to have been badly depauperated of biotypes. Furthermore they are in general oceanic and coast-bound, though a few penetrate inland in Alaska and eastern Siberia. The Mackenzie Mountains are isolated from them not only because of the suspected inability of the plants to migrate, but also because of their obvious preference for coastal habitats. Only one of the 77 species was found at Brintnell Lake, *Carex nesophila;* but in view of its recent discovery also in the Richardson Mountains and in the central Yukon region it probably belongs among the northern Beringian groups rather than among the southern, more oceanic ones.

### *Northern Beringia radiants*

Plants whose equiformal areas are thought to center in Northern Beringia are discussed by Hultén in four groups: species with ranges principally (1)

American, (2) Asiatic, (3) bilateral across Northern Beringia, and (4) having extensions southward to and along the north Pacific coasts. We are concerned here only with those that appear in America.

Approximately 114 species are noted in the first of these four categories, and 31 of them have been listed at Brintnell Lake. They are treated by Hultén in three groups: first a "rigid" group which is predominantly arctic; second, a "plastic" group that is more southern; and finally a very plastic group with wide ranges in the subarctic. Hultén believes that these three groups had somewhat different histories during and after the Pleistocene, depending upon their original habitat preferences. The first lived in the more northern, arctic parts of Beringia where they were greatly reduced by the maximum ice. They include some of our "most arctic" species. The second are thought to be ". . . less arctic and not montane. . . . They do not occur in the Arctic Archipelago and, except Beringia, they occupy chiefly glaciated areas. . . . They thus possess a much more plastic area than the former group. . . ." The third are thought to have ". . . covered so extensive an area on the D-interglacial that they had reached the southern boundary-line of the maximal ice before the maximal glaciation." With such large undepauperated populations to draw from they have been among the most successful plants in filling the gaps made by the glaciers.

The equiformal figures made from the ranges of the rigid and plastic groups appear to be fairly consistent, with a few exceptions. We find among the rigid species *Saxifraga tricuspidata* and *Dryas integrifolia*, both of which are widely distributed in the northern Rocky Mountains as well as in the Arctic. Hultén notes that they appear to have been especially successful at spreading in spite of their supposed depauperation. It seems more reasonable to place them among his Arctic–Montane group (see below). Among his plastic species, so long as they are confined to the far northwest, the figures appear reasonable; but when species with wider ranges are considered many are found to be nearly identical with his Continental Western American radiants. Such plants are *Betula papyrifera* var. *humilis*, *Salix arbusculoides*, *Carex physocarpa*, *Parnassia Kotzebuei*, *Cypripedium passerinum*, and *Solidago multiradiata*. Finally it is difficult to see why three of the primary species of the Canadian forest, *Picea glauca*, *P. mariana*, and *Larix laricina* s. l., along with several of the more characteristic species of large sections of this forest region [2] should be placed among the Northern Beringian radiants. Their ranges are nearly or quite identical with many other forest species that are classified among the Continental Western American radiants, and there is no clear reason to think they have had a different history. If there is evidence that a species had access to the larger refugia during the Pleistocene, it seems unnecessary and somewhat misleading to attach it to an equiformal area centering on one of the lesser refugia.

With these things in mind I have altered Hultén's lists by reclassifying the wide-ranging plants above mentioned. The resulting total list of Northern Beringian radiants is thereby reduced to approximately 90, of which 15 have been found at Brintnell Lake. The 15 species are as follows:

[2] *Mertensia paniculata*, *Geum macrophyllum* var. *perincisum*, *Aquilegia brevistyla*, *Ribes hudsonianum*, *Agropyron dasystachyon*, *Festuca saximontana*, *Luzula saltuensis*, *Ribes glandulosum*, *Impatiens biflora*, *Cornus stolonifera*, *Orchis rotundifolia*, *Primula mistassinica*, *Corydalis sempervirens*.

*Rigid group:*

*Taraxacum alaskanum*
*Saxifraga radiata*
*Astragalus frigidus* var. *littoralis*
*Oxytropis pygmaea*
*Lupinus arcticus*
*Salix Richardsonii*
*Salix alaxensis*
*Oxytropis Maydelliana*
*Carex membranacea*
*Taraxacum lacerum*

*Plastic group:*

*Carex podocarpa*
*Arctagrostis arundinacea*
*Poa paucispicula*
*Polemonium acutiflorum*
*Larix laricina* ssp. *alaskensis*

The second main group of Northern Beringia radiants with which we are concerned are those called by Hultén the Bilateral Radiants of Northern Beringia. There are 45 of these, including one (*Erigeron eriocephalus*) that I have added. Five of the 45 are found at Brintnell Lake. Reference to Hultén's map (*Pl. 13*) and discussion (pp. 57–60) indicates that this group is analogous to his American and Asiatic radiants from Northern Beringia, and differs from them chiefly in extending on both sides of Bering Strait. The most widespread of them become the high arctic circumpolar species. Many of them now show gaps in their ranges, but Hultén thinks they were probably all completely circumpolar in the D-interglacial. With them he groups the so-called "amphiAtlantic" and "west-arctic" species, such as *Saxifraga aizoides* and *Arenaria humifusa*, whose Bering Straits–eastern Asiatic components are thought to have been destroyed by the last ice. The question naturally arises as to whether this is justifiable if the Beringian area is to be looked upon as the most important refuge available to such plants. Recent collections, however, particularly in the Rocky Mountains, suggest that it may not be necessary, at least in America, to relate them to Beringia. Furthermore, *Arenaria humifusa* is now reported from there.

The five species found in the Mackenzie Mountains are *Arenaria humifusa, Saxifraga aizoides, Potentilla emarginata, Pyrola grandiflora,* and *Erigeron eriocephalus.* A glance at their ranges shows that all but the last have now been found in the northern Rocky Mountains, so that it probably is more logical to consider all but the *Erigeron* with the Arctic–Montane radiants (see below) rather than with the Northern Beringia radiants. This group of plants brings out the significance of the gap in the botanical exploration of northern British Columbia.

The third group of Northern Beringia radiants represented in America is called "Arctic–Pacific." It is characterized by Hultén as ". . . closely related to that one [arctic circumpolar plants] and with exactly the same history, the only difference being that it includes those arctic circumpolar plants that have also reached the southern shore of Beringia. . . . (It should be remembered that all arctic plants are to be regarded as more or less oceanic, as they are confined to a strip along the shore of an ocean)." He lists 41 species here, of which 11 have been found at Brintnell Lake. The latter are as follows: *Poa glauca, Luzula Wahlenbergii, Salix arctica* s. l., *Salix pulchra, Aconitum delphinifolium, Anemone Richardsonii, Ranunculus nivalis, Draba cinerea, Pinguicula villosa, Antennaria monocephala, Arnica Lessingii.*

I find it difficult to place all of these 11 species in any single category of ranges, and many of them do not seem to fit the conditions set up by Hultén for his Arctic–Pacific group. *Antennaria monocephala* and *Aconitum delphinifolium* are strongly represented in southern Beringia; but they are scarcely

arctic in Alaska, and in the eastern part of their ranges they are decidedly continental. The same can be said of *Anemone Richardsonii* except that it does have a somewhat more arctic extension. It is represented in the Arctic Archipelago, however, only in the western part. *Poa glauca* is a decidedly continental species except in the Arctic, and it appears to be only slightly represented on the north Pacific coasts. All four of these could as well be placed with the Continental western American radiants, or the last two with the Arctic–Montane group. *Poa glauca,* a highly polymorphic species, is actually one of our most widely dispersed boreal grasses. Except for the North Pacific coast, it could be grouped, so far as boreal America is concerned, with such wides as *Cystopteris fragilis* and *Equisetum arvense*.

Lack of clarity in the taxonomy of arctic *Draba* makes it impossible for me to know what Hultén had in mind for *D. cinerea,* but as the species is mapped here it can hardly be related to his Arctic–Pacific group. It may belong with the Arctic–Montane plants.

The realignments noted above reduce Hultén's original list to 36 species, and they reduce the Brintnell Lake representatives to 6. Two of the 6 remain somewhat doubtful. The northern and eastern ranges of *Luzula Wahlenbergii* are probably not complete because it has not always been clearly distinguished from related species, but as mapped here it is not a conspicuously arctic plant. *Pinguicula villosa* is likewise not notably arctic, but is rather a "timber line species."

The "Atlantic–Pacific" species of Hultén's classification are for the most part strongly oceanic in habitat preference, and are not represented at Brintnell Lake at all.

### *Western American coast radiants*

Hultén lists 263 species as having a strong Pacific coast affinity in America. I have added 4 more, making a total of 267. Of these, 23 have been found at Brintnell Lake.

Hultén's list is divided into four groups which are mapped separately (*Pls. 16–19*). The first two contain plants that are distinctly western American in the sense that they do not reach the eastern coasts, while the last two comprise species that have continuous ranges across the continent or have separate eastern and western components. The selection of species for these last two groups appears to be somewhat arbitrary, for it involves drawing plants from the great mass of subarctic wides, as it did in the case of the Northern Beringia Radiants. One could place most of these species just as well in the Western Continental Radiants or group them with the Boreal Circumpolar wides.

The first two groups, however, can be related to the Pacific coasts. They are divided into those that spread widely from Southern Beringia southeastward into the United States, and those that do not reach Bering Sea at all, but have an extensive range in the north Pacific area. Of the former group Hultén thinks ". . . that they occupied the southern coast of Beringia in the early part of the D-interglacial and radiated from there towards California, some few also towards Yezo. They had reached the southern boundary of the ice before the maximum glaciation, which they survived on the one hand in Beringia and on the other hand south of the ice." Concerning the latter group he states that it ". . . is naturally very large, as it comprises those plants that lived south of the ice during the maximum glaciation and then progressed along the coast

towards Alaska when the ice-sheet retreated. They can have migrated parallel to the southern edge of the ice during the glacial. Probably the coast was among the first areas to be free from ice and as furthermore there must have existed a dry continental shelf, although a narrow one, the plants south of the ice must have had a good opportunity, without competition from other plants, of advancing northward along the coast."

Hultén's figures for the two groups just mentioned have been modified not only by the addition of 2 species, but also by changing 2 species from the second to the first. *Draba nivalis* var. *elongata* (*D. lonchocarpa*) and *Phyllodoce glanduliflora* have now been found on the Beringian coasts. The two species added are *Carex pyrenaica* and *Cryptogramma crispa* var. *sitchensis*. The first was taken from Hultén's Arctic–Montane Radiants.

The plants represented in Hultén's *Plates 18* and *19,* with their extensive ranges across America, are thought to have survived the last ice ". . . in an unbroken zone along the southern margin of the ice," and to illustrate the great spreading capacity of plants not greatly depauperated of biotypes.

The 23 species of West American Coast radiants represented at Brintnell Lake are as follows:

*Ranunculus Eschscholtzii*
*Salix Barclayi*
*Juncus Drummondii*
*Saxifraga Lyallii*
*Hieracium gracile*
*Hippuris montana*
*Draba nivalis* var. *elongata*
*Arabis lyrata* var. *kamchatica*
*Cryptogramma crispa* var. *sitchensis*
*Phyllodoce glanduliflora*
*Carex pyrenaica*
*Salix Scouleriana*
*Salix commutata*
*Senecio triangularis*
*Parnassia fimbriata*
*Carex phaeocephala*
*Carex leptalea*
*Heracleum lanatum*
*Cornus canadensis*
*Agrostis scabra*
*Habenaria hyperborea*
*Alnus crispa*
*Viburnum edule*

### *Continental western American radiants*

This group is looked upon as more or less parallel, historically, to the West Coast Radiants, differing chiefly in being strongly continental. It is broken up into two main groups, ". . . those that do not reach the Bering Sea but stop in the Yukon valley, and those that reach Beringia. The former group apparently survived the maximum glaciation in the upper Yukon valley . . . or in the mountains south of it, the latter group also possessed stations in Beringia during that period."

Hultén lists 158 species as Continental West American Radiants. The ranges of 138 of them are presented in his *Plates 20, 21,* and *22,* while the other 20 are given similar histories although they are now thought to show gaps in their ranges. On the basis of Brintnell Lake studies I have added 19 species not discussed by Hultén. It is now possible to alter Hultén's subdivisions of the group to a certain extent. *Salix myrtillifolia, Salix Barrattiana, Salix Bebbiana, Actaea rubra,* and *Carex concinna* all extend farther west in Alaska than he indicates; and *Populus tremuloides, P. Tacamahacca,* and *Betula glandulosa* (incl. *B. sibirica*) probably reach Bering Sea. The following are listed as not reaching the eastern American coasts, although they all do so: *Salix myrtillifolia, Listera borealis, Salix Bebbiana, Actaea rubra, Agropyron trachycaulum* var. *unilaterale, Carex concinna.*

I have also added 13 species by reclassifying plants listed by Hultén in other categories. One of these, *Arabis Drummondii*, is taken from his Pacific Coast radiants, but the remainder are from his Northern Beringian elements (see above). The latter are as follows:

*Betula papyrifera* var. *humilis*
*Salix arbusculoides*
*Cypripedium passerinum*
*Solidago multiradiata*
*Parnassia Kotzebuei*
*Aquilegia brevistyla*
*Mertensia paniculata*
*Ribes hudsonianum*
*Ribes glandulosum*
*Cornus stolonifera*
*Picea glauca*
*Picea mariana*

Including the additions noted above there are 190 species in Hultén's Continental West American group. Of these, 73 have been found at Brintnell Lake. No attempt will be made to subdivide them according to Hultén's scheme, since this would involve the reclassification of a number of his ranges. In the following list, however, the 73 species are arranged, in general, according to his sequence.

*Salix myrtillifolia*
*Salix Barrattiana*
*Delphinium glaucum*
*Listera borealis*
*Arctostaphylos Uva-ursi* var. *adenotricha*
*Arnica mollis*
*Abies lasiocarpa*
*Alnus tenuifolia*
*Actaea rubra*
*Agropyron trachycaulum* var. *unilaterale*
*Geum macrophyllum* var. *perincisum*
*Carex concinna*
*Fragaria glauca*
*Carex albo-nigra*
*Carex atrata* ssp. *atrosquama*
*Antennaria media*
*Draba praealta*
*Potentilla diversifolia* s. l.
*Draba McCallae*
*Erigeron jucundus*
*Poa Buckleyana*
*Ribes hudsonianum*
*Aquilegia brevistyla*
*Betula papyrifera* var. *humilis*
*Populus tremuloides*
*Shepherdia canadensis*
*Ribes lacustre*
*Populus Tacamahacca*
*Carex aurea*
*Carex Garberi* var. *bifaria*
*Betula papyrifera* var. *commutata*
*Carex deflexa*
*Geocaulon lividum*
*Ledum groenlandicum*
*Betula glandulosa*
*Smilacina stellata*
*Erigeron elatus*
*Senecio pauperculus*
*Amelanchier florida*
*Senecio indecorus*
*Agropyron trachycaulum* var. *novae-angliae*
*Dryas Drummondii*
*Arenaria dawsonensis*
*Arabis Holboellii*
*Ribes oxyacanthoides*
*Arnica alpina* ssp. *tomentosa*
*Cornus stolonifera*
*Ribes glandulosum*
*Arabis Drummondii*
*Senecio lugens*
*Gentiana propinqua*
*Zygadenus elegans*
*Rubus acaulis*
*Habenaria obtusata*
*Ranunculus Gmelini* var. *Purshii*
*Hedysarum alpinum* var. *americanum*
*Salix Bebbiana*
*Ribes triste*
*Carex gynocrates*
*Pyrola asarifolia* var. *incarnata*
*Viola epipsila*
*Carex physocarpa*
*Draba longipes*
*Picea glauca*
*Picea mariana*
*Mertensia paniculata*
*Parnassia Kotzebuei*
*Solidago multiradiata*
*Cypripedium passerinum*
*Salix arbusculoides*
*Gentiana glauca*
*Campanula lasiocarpa*
*Boschniakia rossica*

Hultén's selection of plants for this list can be criticized at several points. Many of the more wide-ranging species could with equal propriety be placed

with his Arctic–Montane group, particularly with those that do not possess an arctic branch. Others are not strictly continental in the west, and could be classified with the Pacific Coast Radiants. The following might be placed in the latter category: *Actaea rubra, Ribes lacustre, Ledum groenlandicum, Pyrola asarifolia* var. *incarnata, Viola epipsila, Carex physocarpa, Campanula lasiocarpa, Boschniakia rossica.*

### *Arctic–montane plants*

Of all the groups set up by Hultén, that of Arctic–Montane plants is probably the most complex. The maps given in his *Plates 27–30* cover the species represented in America, and involve 144 plants. An additional 56 species are considered to have had their ranges derived from similar patterns, but they are not included in the maps.

The group as a whole is perhaps best characterized in Hultén's own words: "The species belonging to this large and interesting group differ distinctly in one specific property from those previously treated. . . . They possess the capacity for living not only on lowlands of arctic or subarctic character but also on mountains in far more southerly districts. . . . They are thus either mountain plants or arctic plants. The peculiar point about the group . . . is that it combines both these specialties and that its plants are distributed as well along the Arctic Shore as on the mountains. Some of them can even stand the conditions along the northern Pacific shore and protrude considerably even there." It is thought that the broad range of habitats used by these plants enabled them to migrate *during* the Pleistocene, and that consequently they are an arctic-alpine group that was not so much depauperated of biotypes as were other groups whose habitat selection was not so wide.

Hultén subdivides the American Arctic–Montane plants into four groups, as follows: (1) those thought to have had their montane element eliminated by the Pleistocene, (2) those with a montane and western arctic development in America but with their largest areas in Eurasia, (3) those having both arctic and montane branches but not extending to the Gulf of St. Lawrence region, and (4) a group similar to the last but reaching the Gulf of St. Lawrence. The disposition of plants among these four groups is open to question. For instance, 47 species are listed in group (1), of which 14 were found at Brintnell Lake. Of the latter, two (*Pedicularis labradorica, Arctostaphylos rubra*) are scarcely arctic. The first appears in the Archipelago only in southern Baffin Island, and does not go north of Disco Bay in Greenland. The second has not been found either in the Archipelago or Greenland. All of the 14 occur in the Rocky Mountains, and 8 of them south at least as far as the Jasper Park district. None of the 14 should be in Hultén's group (1), therefore. In group (3), *Poa arctica* reaches the Gulf of St. Lawrence, and *Luzula arcuata* has no arctic branch at all. In group (4) *Epilobium davuricum* and *Eriophorum Scheuchzeri* do not show montane branches in the British Columbia and Alberta Rockies. It should be pointed out further that a number of the plants listed in group (4) are not conspicuously arctic, especially in the east. These are as follows: *Betula occidentalis, Taraxacum ceratophorum, Veronica alpina* var. *unalaschcensis, Carex media, Salix planifolia, Valeriana septentrionalis, Oxytropis foliolosa.* Some of these are definitely limited to the forested regions: *Betula occidentalis, Carex media, Valeriana septentrionalis.*

A notable source of error in Hultén's selections may be discussed here, though it also appears in other parts of his paper. He includes in his group 1 plants thought to have had their montane elements destroyed during the Late Wisconsin period. Such plants, however, lacking montane extensions, become eligible to classification as northern Beringian Radiants. If this reasoning were carried to its logical conclusion most of the more plastic northern Beringian plants, those with wide arctic ranges, could be taken out of that category and placed with the arctic-montane group. The only real criteria upon which we can base judgments in these complicated problems are the actual existing positions and sizes of the ranges of the plants, and their degree of specific segregation. From these we can draw inferences as to the geographic preferences and spreading capacities of the plants. If an arctic plant fails to appear in the Rocky Mountains it seems to me more logical to assume either that it is unable to migrate there or has not yet had time to, than to class it with other Arctic–Montane plants which have achieved the wider range. This is particularly true since the Arctic–Montane group as a whole is thought to have suffered much less depauperation during Late Wisconsin time than the Beringian groups.

In the course of this study I have made several changes in Hultén's lists of Arctic–Montane plants. Twelve species and varieties found in the Mackenzie Mountains were not discussed by him, but seem most nearly related to this series. Twenty other species have been taken from four of his other equiformal groups and added here because their areas appear more nearly to fit the Arctic–Montane pattern. These are as follows: from Northern Beringia Radiants—*Dryas integrifolia, Saxifraga tricuspidata;* from Bilateral Radiants of Northern Beringia—*Arenaria humifusa, Saxifraga aizoides, Potentilla emarginata, Pyrola grandiflora, Taraxacum lapponicum, Arenaria sajanensis, Sagina Linnaei;* from Arctic–Pacific Radiants—*Draba cinerea, Antennaria monocephala, Anemone Richardsonii, Poa glauca, Aconitum delphinifolium;* from Boreal–Circumpolar plants—*Petasites frigidus, Aster sibiricus, Chrysosplenium tetrandrum, Carex microglochin, Calamagrostis canadensis* var. *Langsdorfi, Lycopodium Selago, Cardamine pratensis, Calamagrostis lapponica.*

The total amended list of Arctic–Montane plants now contains 235 species, of which 100 have been found at Brintnell Lake. The latter are as follows. Although they are not broken down into the 4 subdivisions made by Hultén, the sequence is approximately that proposed by him.

*Festuca altaica*
*Sedum roseum* var. *integrifolium*
*Salix reticulata*
*Pedicularis labradorica*
*Vaccinium uliginosum* var. *alpinum*
*Dryopteris fragrans*
*Hierochloë alpina*
*Arctostaphylos rubra*
*Salix glauca*
*Lycopodium alpinum*
*Arenaria verna* var. *pubescens*
*Saxifraga nivalis*
*Pedicularis sudetica*
*Cerastium Beeringianum*
*Cardamine pratensis*
*Calamagrostis lapponica* s. l.
*Potentilla uniflora*
*Saxifraga punctata*
*Artemisia arctica*
*Myosotis alpestris*
*Corydalis pauciflora*
*Lloydia serotina*
*Anemone narcissiflora*
*Aconitum delphinifolium*
*Antennaria monocephala*
*Artemisia Tilesii* s. l.
*Petasites frigidus*
*Aster sibiricus*
*Pedicularis capitata*
*Pedicularis lanata*
*Cassiope tetragona*
*Agropyron latiglume*
*Saxifraga tricuspidata*
*Poa arctica*

*Lychnis apetala*
*Luzula arcuata*
*Dryas octopetala*
*Oxytropis hyperborea*
*Arenaria Rossii*
*Gentiana arctophila*
*Crepis nana*
*Oxytropis hudsonica*
*Oxytropis ixodes*
*Antennaria isolepis*
*Cornus canadensis* f. *purpurascens*
*Draba cinerea*
*Antennaria subviscosa*
*Anemone Richardsonii*
*Betula occidentalis*
*Chrysosplenium tetrandrum*
*Hedysarum Mackenzii*
*Epilobium davuricum*
*Calamagrostis purpurascens*
*Stellaria longipes* var. *Edwardsii*
*Carex scirpoidea*
*Festuca brachyphylla*
*Epilobium latifolium*
*Cardamine bellidifolia*
*Erigeron unalaschkensis*
*Carex nardina* var. *Hepburnii*
*Saxifraga rivularis*
*Ranunculus hyperboreus*
*Astragalus alpinus*
*Taraxacum ceratophorum*
*Potentilla nivea*
*Draba fladnizensis* var. *heterotricha*
*Tofieldia palustris*
*Lycopodium Sclago*
*Silene acaulis* var. *exscapa*
*Luzula spicata*
*Veronica alpina* var. *unalaschcensis*
*Carex media*
*Carex bipartita*
*Poa alpina*
*Polygonum viviparum*
*Oxyria digyna*
*Epilobium anagallidifolium*
*Carex capillaris*
*Juncus castaneus*
*Trisetum spicatum* var. *Maidenii*
*Saxifraga oppositifolia*
*Eriophorum Scheuchzeri*
*Salix planifolia*
*Sibbaldia procumbens*
*Anemone parviflora*
*Valeriana septentrionalis*
*Luzula confusa*
*Draba glabella*
*Oxytropis foliolosa*
*Sagina Linnaei*
*Arenaria sajanensis*
*Taraxacum lapponicum*
*Pyrola grandiflora*
*Potentilla emarginata*
*Saxifraga aizoides*
*Arenaria humifusa*
*Poa glauca*
*Dryas integrifolia*
*Carex microglochin*
*Calamagrostis canadensis* var. *Langsdorfi*

A few of the maps included in the present paper are at variance with Hultén's due to difference in species concepts. *Salix glauca*, for instance, is considered by Hultén in a very broad sense, to include *S. cordifolia*. I have mapped it in a more restricted sense, and have included only forms distinguished as *S. glauca* by Schneider. *Cassiope tetragona* is mapped in its broad sense, to include subsp. *saximontana*. In *Draba fladnizensis*, apparently considered by Hultén in a broad sense, I have mapped only var. *heterotricha*.

### *Boreal circumpolar plants*

This is the last, and one of the larger groups of plants set up by Hultén. He has mapped 214 species, and discusses 41 others, or 255 in all. He calls it the "boreal group" and distinguishes it as follows: "Two groups of circumpolar plants have now been discussed, viz., the arctic and arctic-montane ones. . . . It now remains to discuss the boreal group. . . . The arctic group survived the maximum glaciation chiefly north of the maximum ice, the boreal plants were so sensitive to the cold that they were able to survive chiefly on the refugia south of the ice." It is thought that one of the principal results of this is that these plants maintained relatively large populations during the later episodes of the Pleistocene, and were not much depauperated of biotypes. The most widespread plants in the boreal world are in this group.

Six plates (*36–41*) and a text-figure (*fig. 14*) are devoted by Hultén to maps of such plants of the boreal group as occur in America. His subdivisions of the group are based largely upon the degree of continuity of the ranges. First are those that show no appreciable gaps in the whole circumboreal area (*Pl. 36*), and then comes a series of ranges showing various kinds of gaps. No attempt will be made here to review his disposition of species through the series; but it should be said that numerous changes might be made, especially in American ranges, due to recent exploration and the filling in of supposed gaps. For instance 38 species are mapped in *Pl. 37* to illustrate species with gaps in the central portion of boreal America. Seven of these were found in the Mackenzie Mountains, but none of the seven now shows an appreciable discontinuity. A number of others in the list have been filled in in the same manner.

I have added only 7 species to Hultén's lists, although some have been taken out and reclassified elsewhere. The latter are *Chrysosplenium tetrandrum, Carex microglochin, Calamagrostis canadensis* var. *Langsdorfi, Lycopodium Selago, Petasites frigidus, Aster sibiricus,* all of which appear to be more properly placed in the Arctic–Montane group. Two of the additions have been taken from the Arctic–Montane group and placed here because of their wide boreal rather than arctic ranges: *Epilobium lactiflorum, Stellaria calycantha.* The other 5 additions were found in the Mackenzie Mountains but are not discussed by Hultén. One of these is the polymorphous *Poa pratensis,* which I have mapped in its broadest sense.

The total amended list of Boreal Circumpolar Species is therefore of 262 plants, of which 52 have been found in the Mackenzie Mountains. The latter are as follows:

*Lycopodium clavatum* var. *monostachyon*
*Cystopteris fragilis*
*Equisetum arvense*
*Epilobium angustifolium*
*Dryopteris Linnaeana*
*Woodsia ilvensis*
*Poa pratensis* s. l.
*Calamagrostis neglecta*
*Carex aquatilis* s. l.
*Carex canescens*
*Corallorrhiza trifida*
*Parnassia palustris* var. *neogaea*
*Equisetum palustre*
*Equisetum fluviatile*
*Vaccinium microcarpum*
*Rubus Chamaemorus*
*Linnaea borealis*
*Potentilla norvegica*
*Moneses uniflora*
*Rorippa islandica* var. *microcarpa*
*Rubus strigosus*
*Vaccinium uliginosum*
*Empetrum nigrum*
*Vaccinium Vitis-Idaea* var. *minus*
*Pyrola secunda*
*Equisetum scirpoides*
*Carex diandra*
*Goodyera repens* var. *ophioides*
*Lycopodium complanatum*
*Poa nemoralis*
*Juniperus communis* var. *montana*
*Equisetum sylvaticum* var. *pauciramosum*
*Carex loliacea*
*Eriophorum brachyantherum*
*Potentilla fruticosa*
*Andromeda Polifolia*
*Rosa acicularis*
*Arenaria lateriflora*
*Calamagrostis canadensis* var. *robusta*
*Equisetum variegatum*
*Lycopodium annotinum* s. l.
*Juncus balticus* s. l.
*Pyrola minor*
*Arctostaphylos Uva-ursi*
*Pyrola virens*
*Epilobium lactiflorum*
*Stellaria calycantha*
*Selaginella selaginoides*
*Ranunculus lapponicus*
*Carex vaginata*
*Draba lanceolata*
*Erigeron angulosus* var. *kamtschaticus*

It will be noted that in several cases I have mapped only American varieties of the circumpolar species, but in most of them the range patterns are essentially the same as those of the aggregate species.

## *Discussion*

Before proceeding to a discussion of the origin and development of the vegetation of southwestern Mackenzie it will be well to compare the results of my own survey of the geographic affinities of the Brintnell Lake flora with those obtained from an application of Hultén's hypotheses. In order to do this I have examined Hultén's disposition of species, as emended in the present paper, in the light of their actual ranges as indicated on the maps. The accompanying TABLES 6 and 7 show first the percentages of the Brintnell Lake plants, arranged according to Hultén, which are drawn from the various groups of actual ranges (*Figs. 4–10*), and second a summary of these percentages as they are related to the larger categories of ranges.

It is clear that Hultén's Boreal Circumpolar group, as represented at Brintnell Lake (52 spp.), is prevailingly of wide continental ranges (98%). It is derived mainly from forest species (78.8%), and if half the "timber-line" and cosmopolitan elements are added, its forest element can be raised to a slightly higher proportion (86.4%). About 50% is of species which extend to the coastal strip in the west.

The Arctic–Montane plants (100 spp.) are also derived from wide-ranging groups, but to a somewhat lesser extent than the Boreal Circumpolar plants (82%). As would be expected, they come principally from our arctic and alpine elements (72%), and if half the "timber-line" element is added this can be raised to 82.5%. In contrast to the Boreal Circumpolar plants, about 51% of the Arctic–Montane group is more or less strictly continental with regard to the western coastal strip.

Among Hultén's Continental West American plants (73 spp.) the proportion of species with wide continental ranges falls to 68.5, leaving 31.5% to come from Alaskan and cordilleran range patterns. They are prevailingly of forest affinities (71.2%, or 73.9% if half the "timber-line" element is added). They are more rigorously continental in the west than the Arctic–Montane group, with 64.4% failing to reach the Pacific coast.

Western American Coast Radiants represented at Brintnell Lake (23 spp.) come principally (69.6%) from our Alaskan and cordilleran groups. Most of them (65.2%) are species with alpine or arctic-alpine range patterns, and nearly all of them (95.7%) occupy the coastal strip from southern Alaska to western Washington.

Beringian Radiants (23 spp. at Brintnell L.) are mostly of western affinity (60.9%), and strongly arctic-alpine (91.3%, or 93.4% if half the "timber-line" percentage is added). They are strictly continental in the west to the extent of 65.2%, and only 1, or 4.3%, extends throughout the coastal country to western Washington.

So far as the above comparisons go the correlation between Hultén's arrangement and my own is fairly good. They do not present a complete picture, however, as a glance at the tables will show. We find, for instance, that while Hultén has derived 78.8% of the Boreal Circumpolar species of the Brintnell Lake flora from strictly forest groups, he has also derived 7% of his Arctic–

TABLE 6.

| | | Beringia Radiants | W. American Coast Radiants | Continental W. American Plants | Arctic-Montane Plants | Boreal Circumpolar Plants |
|---|---|---|---|---|---|---|
| | Cosmopolitan in Canada and Alaska | | | | | (3)[1] 5.7 |
| Wide-ranging forest species | Reaching coasts of Alaska, B. C. and W. Wash. | | (7) 30.4 | (10) 13.7 | | (21) 40.4 |
| | Reaching coasts of S. E. Alaska | | | (7) 9.6 | | (6) 11.5 |
| | Avoiding coasts, S. E. Alaska to Washington | | | (29) 39.7 | (5) 5.0 | (14) 26.9 |
| Wide-ranging arctic or arctic-alpine species | Reaching coastal mts., Alaska to Washington | (1) 4.3 | | | (16) 16.0 | (2) 3.8 |
| | Reaching coastal mts. of S. E. Alaska | (2) 8.7 | | | (16) 16.0 | |
| | Avoiding coastal mts., S. E. Alaska to Wash. | (5) 21.7 | | | (24) 24.0 | |
| Wide-ranging "timber-line" species | Reaching coast of S. E. Alaska | | | | (6) 6.0 | (4) 7.7 |
| | Avoiding coasts S. E. Alaska to Washington | (1) 4.3 | | (4) 5.4 | (15) 15.0 | (1) 1.9 |
| Alaskan-cordilleran species | Reaching coasts Alaska to Washington | | (1) 4.3 | (4) 5.4 | (6) 6.0 | |
| | Reaching coasts of S. and S. E. Alaska | (5) 21.7 | (1) 4.3 | (4) 5.4 | (4) 4.0 | (1) 1.9 |
| | Avoiding coasts S. E. Alaska to Washington | (9) 39.1 | | (3) 4.1 | (7) 7.0 | |
| Cordilleran species | Reaching coasts, S. Alaska to Washington | | (14) 60.8 | (1) 1.4 | (1) 1.0 | |
| | Avoiding coasts, S. Alaska to Washington | | | (11) 15.0 | | |

[1] Figures in parentheses indicate the numbers of species.

Montane plants, 71.2% of his Continental West American plants, 34.8% of his West American Coast Radiants, and 4.3% of his Beringian Radiants from the same source. Most of the species in this source are wide-ranging across the continent.

TABLE 7.

| | Beringia Radiants | W. American Coast Radiants | Continental W. American Plants | Arctic-Montane Plants | Boreal Circumpolar Plants |
|---|---|---|---|---|---|
| Plants of wide range across the continent | (9) 39.1 | (7) 30.4 | (50) 68.5 | (82) 82.0 | (51) 98.0 |
| Ranges mainly in Alaska and the Cordillera | (14) 60.9 | (16) 69.6 | (23) 31.5 | (18) 18.0 | (1) 2.0 |
| Plants of the forested country | (1) 4.3 | (8) 34.8 | (52) 71.2 | (7) 7.0 | (41) 78.8 |
| Arctic, arctic-alpine, or alpine species | (21) 91.3 | (15) 65.2 | (17) 23.3 | (72) 72.0 | (3) 5.7 |
| "Timber-line" species | (1) 4.3 | | (4) 5.4 | (21) 21.0 | (5) 9.6 |
| Cosmopolitan | | | | | (3) 5.7 |
| Continental with regard to S. E. Alaska, B. C., and Washington | (15) 65.2 | | (47) 64.4 | (51) 51.0 | (15) 28.8 |
| Avoiding coasts of B. C. and Washington, but occurring in S. E. Alaska | (7) 30.4 | (1) 4.3 | (11) 15.0 | (26) 26.0 | (11) 21.1 |
| Extending into coastal strip, S. E. Alaska to Washington | (1) 4.3 | (22) 95.7 | (15) 20.5 | (23) 23.0 | (26) 50.0 |

This can be illustrated also with the Arctic–Montane group, of which 82.5% (including half the "timber-line" element) are derived from my arctic-alpine plants. Hultén derives approximately 10.7% of his Boreal Circumpolar group, 26% of his Continental West American plants, 65.2% of his West American Coast Radiants, and 93.4% of his Beringian Radiants from the same source.

As previously stated, Hultén, in building his "equiformal progressive areas" outward from their centra, had to draw increasing numbers of species from the great groups of wide-ranging arctic-alpine and forest plants. The above tables and comparisons give a rough index of the extent to which he did this. Correlations with actual range patterns, made within his major groups, are fairly good. As would be expected a large percentage of the Boreal Circumpolar plants come from the wide-ranging forest species. Likewise it is logical to find that most of the Beringian and Arctic–Montane groups are among the widespread arctic and alpine ranges. Since most of the Alaskan–Cordilleran element in the Brintnell Lake flora consists of arctic-alpine species, it is to be expected that Hultén's West Coast Radiants should show a large proportion from this source. It is also reasonable that his West Coast Radiants should all be present in the coastal strip, and that his Continental West American species should be prevailingly continental in the west. At the same time it is clear that the principal range patterns as I have designated them are more or less heterogeneous with regard to the lesser representations of Hultén's categories.

Among the Beringian Radiants 39.1% (9 spp.) are plants of wide range across the continent, nearly all of them arctic. Judging by their actual range patterns these species could as well be placed among the Arctic–Montane group, and their attachment to a Beringian center of origin is difficult to justify. They indicate the submergence of the Beringian equiformal progressive areas into the heterogeneous assemblage of wide-ranging arctic-alpine species.

The same analysis may be made of the West American Coast Radiants. No less than 30.4% of them are plants of wide continental range, about two-thirds of them from the arctic-alpine ranges and about one-third from the forested country. These 30.4% (7 spp.) could as well be classified as Arctic–Montane or Boreal Circumpolar. Among the Continental West American plants represented at Brintnell Lake 68.5% (50 spp.) are of wide range across the continent, most of them in the forests. An obvious reason for the selection of these species from the forest wides is their relative continentality in the west, but in Hultén's arrangement even this breaks down to the extent of about 35% of the cases.

The above analysis suggests that the identity of Hultén's "equiformal progressive areas," in terms of the species that compose them, can be maintained only in or near their "centra" where groups of plants having limited ranges are concentrated. It is possible to find, in some cases, concentric ranges that justify the enlargement of the centra in certain directions, indicating trends of geographic development. Hultén has done this admirably, and has pointed out not only the probable locations of the centra, but also the probable routes by which boreal America has acquired its post-Glacial flora. Most of the arctic and subarctic flora of North America, however, is composed of "pools" of wide-ranging species, into which Hultén's equiformal concentric ranges disappear. The great arctic-alpine, or Arctic–Montane pool absorbs on one hand the Northern Beringia Radiants, and on the other the alpine elements of the Continental Western American, and parts of the Western American Coast Radiants. Other parts of the last two, as well as some Beringian elements as they were originally constituted by Hultén, become lost in the wides of the forested regions.

The sorting of the wides, therefore, into groups representing their centers of origin seems impracticable except within certain limits. Arctic-alpine species can be separated reasonably well from those of the forests. Indications of continentality can be found in the behavior of plants with relation to the western coastal strip, and in the extent of their extreme northwestern limits. With our present knowledge of post-Glacial climatic and geological history, and with our present limited data on existing environmental conditions as well as on the genetic constitution of the species, it seems unwise to attempt further subdivisions.

It is remarkable, however, as will be shown below, that in spite of the obvious discrepancies between Hultén's arrangement of the species and the evidence from their actual ranges, the correlations as a whole are positive enough to justify about the same conclusions from his methods with regard to the origin of the Brintnell Lake flora as are reached by the methods I have used. This I believe can be put down to Hultén's perspicacity in handling the somewhat imperfect data he had on North American ranges.

## ORIGINS OF THE FLORA OF SOUTHWESTERN MACKENZIE

Whether or not there were ice-free land surfaces in southwestern Mackenzie during the Late Wisconsin ($W_3$) glacial episode is still uncertain. I have shown in a recent paper (1946) that a large triangular area in Alberta and southern Saskatchewan was in all probability uncovered during this period. The location of the northern apex of the triangle, formed by the junction of Keewatin and mountain glaciers, is unknown, but it is not likely that it reached north to the 60th parallel. For the Brintnell Lake region I have presented evidence that summits and upper slopes above approximately 5000 feet were not covered.

If there were ice-free summits in the Mackenzie Mountains, their flora must have been composed of the arctic-alpine remnants of a wide pre-Late Wisconsin dispersal of these plants. A few species found at Brintnell Lake suggest this. First are those of wide range in Eurasia but not known elsewhere in North America: *Saxifraga sibirica, Calamagrostis lapponica* s. str., *Arnica alpina* s. str.; second are the suspected endemics, of which there are eight. Most of the endemics, however, appear to be "incipient" rather than well-defined morphological segregates. Considering the small number of these unique plants, the paucity of the Brintnell Lake flora as a whole, and the present state of botanical exploration in vast areas of the northwest, it is hardly justifiable to set up the Mackenzie Mountain region, at least so far as the eastern slopes are concerned, as a refuge equivalent to those of Beringia, the north Pacific coasts, or the Yukon Plateau. It seems more reasonable to assume that although a few alpine plants may have persisted at Brintnell Lake during Late Wisconsin time, most of the flora has arrived during and since the retreat of the last valley glaciers. The findings of Mr. Porsild on the western slopes of the mountains may require modification of this view.

The length of time involved since the final retreat of the ice is highly conjectural. On the basis of Antevs' conclusions (1931, 1933) I have suggested (l. c.) that the ice did not disappear entirely from Great Slave Lake until near the advent of the post-Glacial climatic optimum. This period is commonly thought to have occurred between 3000 and 9000 years ago. It is not impossible that the latest moraines at Brintnell Lake are of approximately equivalent age. Porsild (1945) believes that he has found some evidence in Macmillan Pass of a climate milder than now exists there.

If Hultén's theories of equiformal progressive areas and varying biotype depauperation are tenable, then it should be possible to draw up a sequence showing the relative availability of plants for the colonization of the Brintnell Lake area during the retreat of the glaciers. It is presumed that for a time after the disappearance of the ice the mountains and adjacent valleys and plains had free access to the alpine and tundra floras of the Rockies, the Cassiars, the Yukon Plateau, the Richardson Mountains, and the arctic lowlands. With the amelioration of the climate coniferous forests eventually covered the valleys of the Mackenzie, upper Liard, Peel, and Wind Rivers, and finally the divides between these streams and the Yukon system. In so doing they effected the isolation of the alpine and arctic elements of the Mackenzie Mountain flora.

Here again the time intervals are conjectural, but probably can be brought within reasonably definite limits. There is fairly good evidence that forests did not appear in the central Mackenzie basin until after the final retreat of the

ice from Great Slave Lake and until after the last of the post-Glacial lakes in the Athabaska–Great Slave Lake region had been drained. Using the reasoning referred to above, therefore, forests did not enter southwestern Mackenzie until the period of the climatic optimum, probably as late as 7000 years ago. They can hardly have reached the higher, interior valleys and divides until somewhat later. The prairies of the upper Mackenzie River country are thought to have developed directly from some form of tundra on the heavier lacustrine soils.

According to Hultén's theory the first aggressive floristic elements to invade the glaciated lands were the Arctic–Montane plants, and such parts of the Beringian and other groups as are supposed to have reached refugia south of the ice before the maximum advance. In both cases these plants were able to maintain large populations during the last great ice advance, and to maintain their genetic plasticity. The most plastic of all Hultén's groups, and certainly the most wide-ranging species, are among the Boreal Circumpolar plants, but since a very large proportion of this group is of forest species, it cannot be expected to show so high a representation in the Mackenzie Mountains as the arctic-alpine group.

Next to the Arctic–Montane plants in a decreasing scale of availability would come the Continental West American Radiants. These are thought to have survived in the Yukon valley and the northern Rocky Mountains, many of them below the ice boundary. Since they contain a large arctic-alpine element they can be expected to be well represented in the Mackenzie Mountains. Furthermore a part of their refuge areas are directly adjacent to the Mackenzie Mountains.

The various Beringian Radiants of Hultén should be rather poorly represented, not only because many of them are thought to have lost their spreading capacity, but also because they, like other alpine elements, were eventually stopped by the advance of the forests. Another small part of the Mackenzie Mountain flora should be derived from the coastal radiants, for they could not be expected to spread far outside the habitats of the relatively warm and wet north Pacific shores. It is true that Hultén allows many of these coastal species to spread widely across the continent, but they are more southern types that would not be expected at high latitudes.

In TABLE 8 I have compared Hultén's floristic elements of the Brintnell Lake area in two ways. First the percentages of the total known flora which are

TABLE 8.

| | Hultén's totals (amended) | Found at Brintnell Lake | % of total Brintnell L. plants | % of Hultén's amended totals |
|---|---|---|---|---|
| Local plants, or plants of limited known range | | 12 | 4.2 | |
| Beringia Radiants | 248 | 23 | 8.1 | 9.3 |
| Atlantic-Pacific plants | 16 | 0 | 0 | 0 |
| W. American Coast Radiants | 267 | 23 | 8.1 | 8.6 |
| Continental W. American Radiants | 190 | 73 | 25.8 | 38.4 |
| Arctic-Montane plants | 235 | 100 | 35.3 | 42.6 |
| Boreal Circumpolar plants | 262 | 52 | 18.3 | 19.9 |
| Totals | 1218 | 283 | | |

derived from the various sources are compared, and second, the percentages of the total numbers of radiants (as revised in this paper) from the various sources that are represented in the mountains. Approximately the same results are reached by both methods. The Arctic–Montane group is present in largest numbers. Over 42% of all the plants listed in the group have been found at Brintnell Lake, and they make up about 35% of the local flora there. Next are the Continental Western American plants, and third, the Boreal Circumpolar group. The Beringian groups, taken together, and the western American Coast Radiants have each supplied only 8.1% of the flora. The most strictly coastal group set up by Hultén, of Atlantic–Pacific plants, is not represented at all.

It will be seen at once that these results correlate very well the series expected on the basis of Hultén's theory. They lend considerable support to his general concept. It should be noted that the results from similar comparisons made with Hultén's unrevised figures are not far different from the above. The positions of the Boreal Circumpolar and Continental West American groups are reversed, but they are not far apart in any case. Some interesting figures appear when the Beringian Radiants are broken down into the various elements outlined by Hultén (TABLE 9).

TABLE 9.

| | Hultén's totals (amended) for the centra | Found at Brintnell Lake | % of total Brintnell L. plants | % of Hultén radiants (amended) |
|---|---|---|---|---|
| S. Beringia Radiants | 77 | 1 | 0.35 | 1.29 |
| N. Beringia Radiants | 90 | 15 | 5.33 | 16.66 |
| Bilateral Radiants of N. Beringia | 45 | 1 | 0.35 | 2.22 |
| Arctic-Pacific plants | 36 | 6 | 2.13 | 16.66 |
| Totals | 248 | 23 | 8.16 | 9.27 |

Although the actual numbers of these species that have reached the Brintnell Lake region is small, the proportions of the total Northern Beringian and Arctic Pacific Radiants are 16.6%. In spite of their relative depauperation, therefore, these plants are nearly as well represented as the Boreal Circumpolar group. It is possible to interpret them as evidence that forests have isolated the alpine flora of the Mackenzie Mountains rather recently, allowing time for Beringian plants to reach the mountains in considerable numbers.

Using data derived from maps presented in this paper, it is possible to arrange a similar sequence of floristic influences that have affected the Brintnell Lake region. The size and character of existing ranges can be used as indicators of the success with which plants have migrated from the Pleistocene refugia.

Considering first the alpine flora, by far the largest single group (66 spp.) is derived from wide-ranging arctic-alpine plants—51.5% of the alpines, or about 23% of the total flora. These are the species that are thought to have maintained comparatively large populations during the Pleistocene, and to have been able to migrate during that time. Second in extent of range are the species that have occupied wide areas in Alaska or the northern Cordillera or both, some of them extending eastward toward Hudson Bay (maps, *Fig. 9-a, b, c; Fig. 10*). There are 49 of these—about 38.2% of the alpines. Finally there are 13 spe-

cies of far northwestern range (map, *Fig. 9-d*), only a few of which extend south of the 60th parallel. They comprise about 10.1% of the alpine plants at Brintnell Lake.

The plants of wide range on the mountains of Alaska, Yukon, British Columbia, and Alberta may well have had access to the large refuge of the Yukon Plateau and to possible refugia in the northern Rocky Mountains and eastern foothills, as well as to those of Beringia. The smallest ranges are those of the Alaskan species which were probably limited to Beringian refugia.

Nearly all of the forest plants at Brintnell Lake are derived from wide-ranging species in boreal America. I have already noted that only ten of the western plants represented are typically forest types. The Brintnell Lake forest flora is clearly derived from lands to the southeastward and has undoubtedly come up from the Liard valley. That of the central Mackenzie region, in turn, as I have suggested in an earlier paper, has probably developed from the amalgamation of populations that persisted through Late Wisconsin time in the East and in the valleys and foothills of the Rocky Mountains. All of these species could have maintained fairly large ranges during that time, and have no doubt increased their spreading capacity by subsequent fusion of populations.

It is impossible to assess accurately the influences of eastern and western forest elements in the Brintnell Lake flora. I have pointed out elsewhere (1946) that morphological characters in tree populations from eastern and cordilleran refugia can be found intermingled in the forests of the central part of the Mackenzie basin. Eastern characters apparently are lacking in the Brintnell Lake forests. Eastern forms of the white spruce, white birch, aspen, and larch were not found there, nor was the jack pine. Whether this applies also to herbaceous and shrubby elements cannot now be determined.

Some further observations on the occurrence of eastern and western geographic varieties may be of interest here. When the whole forest flora of the Mackenzie basin is considered, it is found that these eastern and cordilleran components within species complexes are limited almost entirely to trees and certain shrubs. Wide-ranging herbs of the Canadian forest show a remarkable uniformity throughout, or a few have varietal segregates that are not readily related to either eastern or western areas.

Among shrubs, on the other hand, it is possible to find a few such segregates. *Alnus rugosa* in the east has a cordilleran counterpart, *A tenuifolia,* while in *Alnus crispa* there is almost complete uniformity. *Viburnum edule, Myrica Gale, Potentilla fruticosa,* and *Betula glandulosa* are essentially uniform throughout. *Rosa acicularis* has several varietal segregates based upon the form of the ripe fruit; but for the most part they are not readily set off geographically, although *R. acicularis* var. *lacorum* may eventually prove to be the most common in the northern Cordillera. Ericaceous shrubs are exceedingly uniform with the possible exception of *Kalmia polifolia,* whose var. *microphylla* is cordilleran. Among the willows there is a varying amount of specific segregation. In *Salix* § *Cordatae,* the *cordata-lutea* complex of the east has a close western relative in *S. Mackenzieana.* Likewise *S. serissima* and *S. lasiandra* are regarded as seperate species, though they merge in the Athabaska country. The sand bar willow, *Salix interior,* appears to merge, somewhere in the northern Rockies, with *S. exigua.* On the other hand, one of the commonest willows in the north, *S. Bebbiana,* is remarkably uniform throughout. The same is true of *S. planifolia, S. candida,* and *S. myrtillifolia.*

All of the trees, with the possible exception of black spruce and balsam poplar, have definable eastern and western varietal or specific segregates. I have already pointed out that the degree of segregation in the tree species is roughly proportional to their mesophytism, i.e., the farther they are from the arctic timber line the more clearly the varieties or species can be defined. Species complexes that have not actually merged their eastern and western parts, such as the firs, hemlocks, and arbor-vitaes, are still looked upon as having separate species in the east and west. This idea can also be applied to shrubs and herbs, with the result that the farther south it is carried the better the segregation becomes. Most of the willows mentioned above as having eastern and western species pairs are usually regarded as separate entities, though with many intermediate forms, while there are other pairs still farther south, such as *Salix subcoerulea* and *S. pellita,* which are usually kept separate without question. Among non-boreal species, both herbaceous and shrubby, eastern and western identities or pairs have long been recognized. They exhibit some of the remarkably disrupted ranges which have been so thoroughly studied by Fernald (1925).

From the above notes the general pattern of specific and varietal segregation in the Canadian forest becomes clear. The farther north one goes the poorer it becomes. There is, however, the anomaly of a widespread community in which the segregation of geographic varieties is more distinct among trees than among herbs, with shrubs in an intermediate position. At present it is possible only to advance a theory to explain this. If our premise is correct that the widespread boreal forest of the northern interior plains has been formed by the amalgamation of eastern and western components since the retreat of the Late Wisconsin ice, then we can visualize the process as being one of hybridization and the intermingling of biotypes. This process would be most rapid in species with the shortest life cycles, which would be the herbs. The shrubs would accomplish the fusion somewhat more slowly, and the trees most slowly of all.

There appears some corroborative evidence for such a gradation when the shrubs alone are considered. The species complexes of upland woods, muskegs, and slough margins show the most complete uniformity, whereas shrubs of river banks have maintained better segregation. This is particularly true of the willows and alders. Adherence to specific limited habitats may thus have constituted a barrier to free interbreeding. On the other hand *Cornus stolonifera,* also a plant of river banks and flood plain woods, shows poor segregation of geographic varieties. It is easily dispersed by birds, however, and may thus have overcome the handicap of its habitat requirements.

In the light of this reasoning, the varietal segregates which appear at Brintnell Lake suggest that most of the forests came there from the foothills of the northern Cordillera rather than from the central Mackenzie basin. Nevertheless eastern elements may be there among herbaceous and shrubby species, submerged in uniform wide-ranging populations that have grown out of the mergence of eastern and western glacial components.

I have not considered the intermediate "timber-line" group, but whether it is placed with forest or arctic elements, it can be thought to have shared the wide ranges of either, and to have maintained great spreading capacity.

By way of summary, therefore, we may picture the Mackenzie Mountains as having been one of the latest montane areas to lose its glaciers (remnants of them still exist). While the glaciers were retreating there was a period of time during which the lower slopes were tundra-covered, with the tundra more or

less continuous across the neighboring valleys and to neighboring mountain ranges. The length of the period is problematical, for it is impossible with present data to measure it accurately. There is some evidence, however, that forests did not come into the lower valleys until about 7000 years ago, and that they did not cover the divides until somewhat later. In any case the tundra period must have been one in which the arctic and alpine plants of all the northwestern refugia had open routes of migration to the Mackenzie Mountains. There is evidence that they availed themselves of these routes in differing proportions, depending first upon their broad habitat preferences, and second upon their inherent abilities to migrate. Their success at colonizing the mountains was conditioned also by the remoteness of the various refugia. Plants of continental habitat preferences were of course most successful; and of these the wide-ranging Arctic–Montane group were outstanding because of both accessibility and lack of biotype depauperation. Survivors in the Yukon valley and the northern Rockies were second in numbers, for they were only partially depauperated and were near at hand. Northern Beringian and Coastal Radiants were next in importance, probably held in check both by distance and lack of plasticity.

The process of alpine colonization appears to have been checked, at least for the Brintnell Lake region, before it had reached anything like completion. Evidence for this is to be found in the general paucity of species in the alpine plant cover. The "partial" nature of the flora is to be seen in all the common arctic families and genera. Such groups as *Potentilla, Senecio, Arnica,* and *Pedicularis,* all represented in surrounding regions by half a dozen or so species, have only 2 to 4 species each in the Brintnell Lake district. The colonization appears to have been stopped by the advance of forests into the surrounding valleys. These forests brought a new element to the mountain flora, derived from refugia south of the ice or on the slopes of the more southern mountains. Whether any of it came from the Yukon valley is uncertain. It was derived from Hultén's Boreal Circumpolar, Continental Western American, and possibly in part from his western coastal groups. In terms of range patterns outlined in this paper it was drawn chiefly from wide-ranging forest species and in part from the "timber-line" group. By nature it is aggressive, but probably shows so small a portion of the total Brintnell Lake flora as it does only because of the short time available for its invasion, and because of the subarctic situation of the Mackenzie Mountains.

## CATALOGUE OF THE VASCULAR FLORA OF SOUTHWESTERN MACKENZIE

The ensuing catalogue contains 725 species and varieties of vascular plants. They are distributed among the major groups as follows: Pteridophyta—35; Gymnospermae—9; Monocotyledoneae—201; Dicotyledoneae—480. The list cannot be looked upon as anything more than an attempt to bring existing knowledge of the flora of southwestern Mackenzie together in one place so that it can be studied and enlarged more intelligently.

It is clear, from an examination of range patterns and the floras of surrounding regions, that the catalogue almost certainly will be enlarged very considerably with further collecting. Using Porsild's work on the lower Mackenzie and the western Arctic (1943) together with my own studies in the Athabaska–Great

Slave Lake area (1936) it is possible to draw up a list of about 240 species and varieties known to occur in one or the other of the two areas, but not yet collected in southwestern Mackenzie. A great many of these, particularly the more southern element which occurs in the Wood Buffalo Park, are to be expected in our region on the Alberta Plateau and in the Mackenzie Lowland physiographic provinces. To have included them in the present catalogue, however, would have necessitated the assumption of range extensions for which there is no actual evidence.

I have admitted certain species to the catalogue although no specimens of them have yet been collected in our region. There are 47 of them, selected from the surrounding floras because they have been found in the Mackenzie basin both north and south of our area. A smaller number, 22, are included on the basis of early records made by Richardson at the time of the Franklin Expeditions. Some of these are admittedly doubtful, but I am inclined to honor them because of the surprising number of supposedly erroneous Richardson records that have been verified in recent years.

In citing literature and synonyms I have included only material that bears directly upon the flora of this region. The symbols indicating the herbaria from which I have cited specimens are as follows:

G.—Gray Herbarium
Can.—National Herbarium of Canada
N.—Herbarium of the New York Botanical Garden
US.—United States National Herbarium

Unless otherwise indicated, the specimens cited are those collected by Dr. J. H. Soper and myself in the season of 1939. The first set of these collections, including types of novelties, will be found in the Gray Herbarium of Harvard University, and the second set in the herbarium of the National Museum of Canada at Ottawa.

## OPHIOGLOSSACEAE

**Botrychium Lunaria** (L.) Sw. in Jour. Bot. Schrad. **1800**[2]: 110 (1801); Hultén, Fl. Alaska & Yuk. Pt. 1: 48 (1941); Porsild in Nat. Mus. Can. Bull. **101**: 14, 29 (1945).

*Osmunda Lunaria* L. Sp. Pl. 1064 (1753).

Mackenzie R. between Wrigley and Blackwater R., *Crickmay 124* (Can.); Nahanni Mt., *Wynne-Edwards 8406* (Can.); Bolstead Cr., Canol Rd. mile 111 E., *Wynne-Edwards 8230* (Can.).

**Botrychium Lunaria** (L.) Sw. var. **minganense** (Victorin) Dole, Fl. Vermont, ed. 3: 1 (1937); Hultén, Fl. Alaska & Yuk. Pt. 1: 48 (1941); Porsild in Nat. Mus. Can. Bull. **101**: 29 (1945).

*Botrychium minganense* Victorin in Trans. Roy. Soc. Can. **21**: 331 (1927).
Mossy slope near summit of Lone Mt., *Wynne-Edwards 8407* (Can.).

**Botrychium multifidum** (Gmel.) Rupr. Beitr. Pfl. Russ. Reich. **11**: 40 (1859).

*Osmunda multifida* Gmel. in Nov. Comm. Acad. Sci. Petrop. **12**: 517 (1859).

Abundant in a small prairie opening on the upland west of Fort Simpson, *9917*. Known in the Mackenzie basin from one other locality, Sand Pt., on the north shore of Lake Athabaska (*Raup & Abbe 4565, 4649, 4654*).

**Botrychium virginianum** (L.) Sw. var. **europaeum** Angstr. in Bot. Notiser **1854**: 68 (1854); Porsild in Nat. Mus. Can. Bull. **101**: 29 (1945).

*Osmunda virginiana* L. Sp. Pl. 1064 (1753).
In damp hollow near summit of Lone Mt., *Wynne-Edwards 8408* (Can.).

## POLYPODIACEAE

**Woodsia ilvensis** (L.) R. Br. Prodr. Fl. Nov. Holl. 158 (1810); Hooker, Fl. Bor.-Am. **2**: 259 (1840); Macoun, Cat. Can. Pl. Pt. 5: 283 (1890); Hultén, Fl. Alaska & Yuk. Pt. 1: 14 (1941).

*Acrostichum ilvense* L. Sp. Pl. 1071 (1753).

Among boulders in coarse slide-rock, south slope of Red Mt., alt. 4500′, *9787;* shale cliffs on west slope of Terrace Mt., alt. 5000′, *9518;* shale cliffs near summit of ridge on Terrace Mt., northeast of camp, alt. 5000′, *9681.*

Occasional to common locally. Noted in Fl. Bor.-Am., from "Canada . . . to . . . Bear L."

**Woodsia glabella** R. Br. apud Richardson, Bot. App. Frankl. Journ. 754 (1823); Hooker, Fl. Bor.-Am. **2**: 259 (1840); Macoun, Cat. Can. Pl. Pt. 5: 282 (1890); Hultén, Fl. Alaska & Yuk. Pt. 1: 13 (1941); Porsild in Nat. Mus. Can. Bull. **101**: 14, 29 (1945).

Liard R., Nahanni Butte to Simpson, *Crickmay 1* (Can.); west ridge of Franklin Mts. at "River-between-two-mountains," alt. 1000′, *Crickmay 8* (Can.); Smith Cr., 4 mi. about mouth, *Crickmay 25* (Can.); Lone Mt., *Wynne-Edwards 8409* (Can.); mountain range west of Bolstead Cr., about mi. 111 E., *Wynne-Edwards 8229* (Can.).

Common on dolomitic rocks in the central and southern parts of the Mackenzie basin. The type of the species is a Richardson specimen from Great Bear Lake.

**Cystopteris fragilis** (L.) Bernh. in Neu. Jour. Bot. Schrad. **1**[2]: 26 (1806); Raup in Jour. Arn. Arb. **17**: 188 (1936); Hultén, Fl. Alaska & Yuk. Pt. 1: 16 (1941); Porsild in Nat. Mus. Can. Bull. **101**: 29 (1945).

*Polypodium fragile* L. Sp. Pl. 1091 (1753).

*Dryopteris austriaca* sensu Porsild in Nat. Mus. Can. Bull. **101**: 29 (1945), non Woynar.

Northwest shore of Great Slave L., *Bedford* (Can.); north of the height of land between Great Slave and Great Bear Lakes, *Bedford* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 2, 3* (Can.); west ridge of Franklin Mts. at "River-between-two-mountains," alt. 1000′, *Crickmay 7* (Can.); rocky spruce woods on southward-facing slope west of Brintnell L., alt. app. 2800′, *9474;* shale crevices and slide-rock, north slope of Colonel Mt., alt. 5500′–6000′, *9644;* crevices in coarse slide-rock, south slope of Red Mt., alt. 4500′, *9727;* shale cliffs in gorge on north slope of Colonel Mt., alt. 3500′, *9835;* north peak of Nahanni Mt., *Wynne-Edwards 8410, 8411* (Can.); Lone Mt., *Wynne-Edwards 8412, 8414* (Can.).

Occasional throughout the area; the only fern collected on Colonel Mt. except *Dryopteris Linnaeana,* which was at the foot of the slope. One of the few plants able to live in the loose shale of steep slopes.

**Cystopteris montana** (Lam.) Bernh. in Neu. Jour. Bot. Schrad. **1**[2]: 26 (1806); Hultén, Fl. Alaska & Yuk. Pt. 1: 18 (1941); Porsild in Nat. Mus. Can. Bull. **101**: 29 (1945).

*Polypodium montanum* Lam. Fl. Franc. **1**: 23 (1778).

Liard R., between Nahanni Butte and Simpson, *Crickway 4* (Can.); north peak of Nahanni Mt., *Wynne-Edwards 8412* (Can.).

**Dryopteris Linnaeana** C. Chr. Ind. Fil. 275 (1905); Hultén, Fl. Alaska & Yuk. Pt. 1: 25 (1941).

*Polypodium Dryopteris* L. Sp. Pl. 1093 (1753); Hooker, Fl. Bor.-Am. **2**: 259 (1840) at least in part.

*Phegopteris Dryopteris* (L.) Fée; Macoun, Cat. Can. Pl. Pt. 5: 270 (1890).

Mossy spruce woods on south shore of Brintnell L., *9330.*

Occasional in the above habitat, but not seen elsewhere in our region. Noted in Fl. Bor.-Am., as occurring from "Canada . . . to . . . Bear Lake."

**Dryopteris Robertiana** (Hoffm.) C. Chr. Ind. Fil. 289 (1905); Hultén, Fl. Alaska & Yuk. Pt. 1: 29 (1941); Porsild in Nat. Mus. Can. Bull. **101:** 29 (1945).

*Polypodium Robertianum* Hoffm. Deutsch. Fl. **2:** 20 (1795).

Lone Mt., *Wynne-Edwards 8416* (Can.); Willow Lake R., 44 mi. above mouth, *Crickmay 13* (Can.).

**Dryopteris fragrans** (L.) Schott. Gen. Fil. *pl. 9* (1834); Hultén, Fl. Alaska & Yuk. Pt. 1: 23 (1941); Porsild in Nat. Mus. Can. Bull. **101:** 14 (1945).

*Polypodium fragrans* L. Sp. Pl. 1089 (1753).

*Aspidium fragrans* (L.) Sw.; Hooker, Fl. Bor.-Am. **2:** 261 (1840); Macoun, Cat. Can. Pl. Pt. 5: 276 (1890).

Rocky spruce forest on south-facing slope (granite) west of Brintnell L., alt. app. 2800′, *9483;* among boulders in coarse slide-rock, south slope of Red Mt., alt. 4500′, *9754;* Little Keele R., Canol Rd., mi. 55 E., *Porsild 11783* (Can.); Trout Cr., Canol Rd., mi. 118 E., *Porsild 11835* (Can.).

Occasional to common in the Brintnell Lake localities cited. Noted in Fl. Bor.-Am. as occurring from "Saskatchewan to the Arctic Sea-coast."

**Dryopteris fragrans** (L.) Schott. var. **remotiuscula** Kom. See Brown, Index N. Am. Ferns 68 (1938); Porsild in Nat. Mus. Can. Bull. **101:** 29 (1945).

*Thelypteris fragrans* (L.) Nieuwl. var. *Hookeriana* Fern. in Rhod. **25:** 3 (1923).

Lone Mt., *Wynne-Edwards 8415* (Can.).

**Dryopteris spinulosa** (O. F. Müll.) Watt in Can. Nat. II. **13:** 159, 403 (1867); Ktze. Rev. Gen. Pl. **2:** 813 (1891).

*Polypodium spinulosa* O. F. Müll. Fl. Fridr. 113, *f. 2* (1767).

North of the height of land between Great Slave and Great Bear Lakes, *Bedford* (Can.).

Apparently rare in the northern part of the Mackenzie basin, and occasional in the southern and southwestern parts (Raup, 1934, 1936).

**Asplenium viride** Huds. Fl. Angl. 385 (1762); Porsild in Nat. Mus. Can. Bull. **101:** 29 (1945).

Lone Mt., *Wynne-Edwards 8417* (Can.).

Previously known in the Mackenzie basin from an unverified record by John Macoun in the mountains along the upper Peace R.

**Pellaea glabella** Mett. ex Kuhn in Linnaea **36:** 87 (1869). See Am. Fern Jour. **7:** 3–5, 77–87 (1917); and **11:** 39–40 (1921).

*Pteris atropurpurea* sensu Hooker, Fl. Bor.-Am. **2:** 264 (1840), non L.

West ridge of Franklin Mts., on limestone, *Crickmay 9* (Can.).

Rare in the southern and central parts of the Mackenzie basin, where it is confined to limestone or dolomitic rocks. Noted by Hooker (Fl. Bor.-Am., as *Pteris atro-purpurea*) from "Canada to Bear Lake. . . ."

**Cryptogramma crispa** (L.) R. Br. var. **acrostichoides** (R. Br.) C. B. Clarke in Trans. Linn. Soc. II. **1:** 460 (1880). See Rhod. **37:** 238–247 (1935).

*Osmunda crispa* L. Sp. Pl. 1067 (1753).

*Cryptogramma acrostichoides* R. Br. apud Richardson, Bot. App. Frankl. Journ. 767 (1823); Hooker, Fl. Bor.-Am. **2:** 264 (1840); Macoun, Cat. Can. Pl. Pt. 5: 261 (1890).

*Cryptogramma crispa* (L.) R. Br. ssp. *acrostichoides* (R. Br.) Hultén, Fl. Alaska & Yuk. Pt. 1: 40 (1941).

North of the height of land between Great Slave and Great Bear Lakes, *Bedford* (Can.).

Variety *acrostichoides* is common in dry crevices, chiefly on pre-Cambrian rocks, throughout the Athabaska–Great Slave Lake country. Though very little collected in southwestern Mackenzie, it probably is widely spread there also. Noted in Fl. Bor.-Am., from "Cumberland House Fort to Bear Lake."

**Cryptogramma crispa** (L.) R. Br. var. **sitchensis** (Rupr.) Hultén, Fl. Alaska & Yuk. Pt. 1: 40 (1941).

*Allosurus sitchensis* Rupr. Beitr. z. Pfl. Russ. Reich. **3:** 46 (1845).

Rocky eastern slope of Red Mt., alt. 5800′, just below summit, occasional, *9725.*

Our plant is clearly the same form as that noted by Hultén as the commonest one in the Aleutian Islands (Fl. Aleut. Isl. 51–52, 1937). It has broadly deltoid sterile fronds, tripinnately dissected, with the ultimate divisions small and obovate. In the division of its fronds it closely resembles *C. crispa* (L.) R. Br., as pointed out by Hultén, but its general form and striped scales relate it more closely to the American *C. acrostichoides.* Fernald (in Rhod. **37**: 238–247, 1935) has maintained the latter as a variety of *C. crispa,* while Hultén (Fl. Alaska and Yuk. Pt. 1: 40, 1941) now gives it subspecific rank. Hultén apparently considers var. *sitchense* as a segregate from ssp. *acrostichoides,* and uses a quadrinomial to express the relationship.

**Polypodium virginianum** L. Sp. Pl. 1085 (1753). See Rhod. **24:** 125 (1922).

North shore of Great Slave L., *Bedford* (Can.).

Common in the Wood Buffalo Park and the Athabaska–Great Slave Lake district, but not yet found northwest of Great Slave Lake.

## EQUISETACEAE

**Equisetum arvense** L. Sp. Pl. 1061 (1753); Macoun, Cat. Can. Pl. Pt. 2: 249 (1890); Raup in Jour. Arn. Arb. **17:** 190 (1936); Hultén, Fl. Alaska & Yuk. Pt. 1: 51 (1941); Porsild in Nat. Mus. Can. Bull. **101:** 14 (1945).

Damp sand bar along Mackenzie R., west of Simpson, *9874;* gravelly thickets along shore of Brintnell Lake, *9309;* shale slope near west end of lake, watered by mineral spring, *9570;* wet ground along small stream on north slope of Colonel Mt., alt. 4500′, *9404.*

Common to abundant in the habitats noted above, but not observed elsewhere about Brintnell Lake. Wet rock slides at the mouths of mountain springs are made conspicuous at a distance by the bright green of this species, which is almost the only vascular plant growing on them. Porsild has noted it as common in Macmillan Pass and elsewhere along the Canol Road.

**Equisetum pratense** Ehrh. in Hanov. Mag. **9:** 138 (1784); Hultén, Fl. Alaska & Yuk. Pt. 1: 56 (1941).

Common in damp lowland woods near Simpson, *9095.*

Not previously observed north of the Wood Buffalo Park (Raup, 1936, p. 190).

**Equisetum sylvaticum** L. var. **pauciramosum** Milde, Mon. Equiset. 292 (1865); Raup in Jour. Arn. Arb. **17:** 190 (1936). See Rhod. **20:** 129–131 (1918).

*Equisetum sylvaticum* sensu Hooker, Fl. Bor.-Am. **2:** 269 (1840), in part; Hultén, Fl. Alaska & Yuk. Pt. 1: 57 (1941), in part.

Resolution, Great Slave L., *Kennicott* (N); northwest shore of Great Slave L., *Bedford* (Can.); mossy bank on north shore of Brintnell L., *9184.*

Occasional to common in lowland woods around Brintnell L. Noted in Fl. Bor.-Am., from "Canada . . . to Fort Franklin on the Mackenzie River," and probably common throughout the upper Mackenzie valley forests. Collected at Great Bear L. by *R. Bell* (Can.).

**Equisetum palustre** L. Sp. Pl. 1061 (1753); Hooker, Fl. Bor.-Am. **2:** 269 (1840); Macoun, Cat. Can. Pl. Pt. 2: 250 (1890); Hultén, Fl. Alaska & Yuk. Pt. 1: 55 (1941); Porsild in Sargentia **4:** 8 (1943); Raup in Jour. Arn. Arb. **17:** 190 (1936).

Lower Slave R., below Grande Detour, *Raup 40;* marshy mud flats at mouth of stream at west end of Brintnell L., *9494;* poplar-spruce woods near west end of Brintnell L., *9448.*

This species is abundant on the newly formed mud flats at the mouth of the glacial stream that comes into the western end of Brintnell L. It shares dominance there with *Eriophorum Scheuchzeri, Juncus castaneus, Carex aquatilis,* and *Arctagrostis arundinacea.* It is also abundant in the rather open woods which develop on these flats, forming a nearly continuous green sward on the forest floor. It is rare in other habitats about the lake. Reported in Fl. Bor.-Am. as far north as the "shores of the Arctic Sea," and by Porsild at Great Bear L. and in the Mackenzie delta.

**Equisetum fluviatile** L. Sp. Pl. 1062 (1753).

*Equisetum limosum* L. Sp. Pl. 1062 (1753); Hooker, Fl. Bor.-Am. **2:** 269 (1840); Hultén, Fl. Alaska & Yuk. Pt. 1: 54 (1941); Raup in Jour. Arn. Arb. **17:** 191 (1936).

Lower Slave R., *Raup 25, 26;* northwest shore of Great Slave L., *Bedford* (Can.); wet meadow along glacial stream near west end of Brintnell L., *9700.*

Common on the higher parts of the wet mud flats at the west end of Brintnell L., where it is associated with *Poa, Calamagrostis, Stellaria,* and *Arctagrostis.* Noted in Fl. Bor.-Am. northward ". . . to the shores of the Arctic Sea."

**Equisetum prealtum** Raf. Fl. Ludov. 13 (1817).

Dry sandy margin of an upland prairie opening west of Simpson, *9927.*

Common in places, with spreading-ascending stems forming a loosely tangled mat. Not previously reported in the Mackenzie basin north of the upper Slave R. (Raup, 1936, p. 191).

**Equisetum scirpoides** Michx. Fl. Bor.-Am. **2:** 281 (1803); Hultén, Fl. Alaska & Yuk. Pt. 1: 57 (1941); Porsild in Nat. Mus. Can. Bull. **101:** 14, 29 (1945).

Swampy woods near Simpson, *9090;* mossy thickets on south shore of Brintnell L., *9339;* in damp hollow on summit of Lone Mt., *Wynne-Edwards 8418* (Can.); north peak of Nahanni Mt., *Wynne-Edwards 8419* (Can.); along Canol Rd. at Sekwi R., mi. 174 E., *Porsild 11843* (Can.).

Abundant in spruce forests throughout the region.

**Equisetum variegatum** Schleich. Cat. Pl. Helvet. 27 (1807); Hooker, Fl. Bor.-Am. **2:** 270 (1840), in part; Hultén, Fl. Alaska & Yuk. Pt. 1: 59 (1941); Porsild in Nat. Mus. Can. Bull. **101:** 14 (1945).

Mud flats at west end of Brintnell L., *9809;* mossy muskeg thickets at west end of lake, *9708;* mossy thickets along south shore of lake, *9359;* grassy alpine meadow on north slope of Colonel Mt., alt. 4000′, *9607;* along Canol Rd. at Sekwi R., mi. 174 E., *Porsild 11842* (Can.); noted by Porsild also in Macmillan Pass, mi. 225 E.

Common to abundant below timber line, in the Brintnell L. area, but only occasional above. It is a primary species over large areas of mud flat at the west end of the lake and appears to form a definite stage in the vegetational development between the marsh and the spruce-poplar woods.

## LYCOPODIACEAE

**Lycopodium Selago** L. Sp. Pl. 1102 (1753); Hooker, Fl. Bor.-Am. **2:** 266 (1840); Macoun, Cat. Can. Pl. Pt. 2: 287 (1890); Hultén, Fl. Alaska & Yuk. Pt. 1: 71 (1941); Porsild in Nat. Mus. Can. Bull. **101:** 14 (1945).

Northeast slope of Red Mt., Brintnell L. area, alt. 5000′, *9269;* Bolstead Cr., Canol Rd., *Wynne-Edwards 8231* (Can.).

Common on the turfy slopes above timber line north of Brintnell L., but not seen on Colonel Mt.

**Lycopodium annotinum** L. var. **alpestre** Hartm. Skand. Fl. ed. 2, 294 (1832); Hultén, Fl. Alaska & Yuk. Pt. 1: 63 (1941). See Rhod. **17:** 123–125 (1915).

Northeast slope of Red Mt., Brintnell L. area, alt. 5000′, *9266.*

Abundant on turfy slopes above timber line. The leaves are much more serrate than those of var. *pungens,* which was collected at lower levels. A specimen with serrate leaves (*Wynne-Edwards 8420,* Can.) cited by Porsild, l. c. 29, as var. *pungens,* probably belongs here, and possibly also his record for *L. annotinum* in Macmillan Pass.

**Lycopodium annotinum** L. var. **pungens** (La Pylaie) Desv. in Mém. Soc. Linn. Paris **6:** 182 (1827); Raup in Jour. Arn. Arb. **17:** 192 (1936); Hultén, Fl. Alaska & Yuk. Pt. 1: 63 (1941). See Rhod. **17:** 123–125 (1915).

Northwest shore of Great Slave L., *Bedford* (Can.); north of the height of land between Great Slave and Great Bear Lakes, *Bedford* (Can.); rich woods near shore at west end of Brintnell L., *9490.*

Common in a few places around Brintnell L., growing in a mat of woodland mosses and lichens.

**Lycopodium clavatum** L. var. **monostachyon** Grev. & Hook. in Hook. Bot. Misc. **2:** 375 (1831); Hultén, Fl. Alaska & Yuk. Pt. 1: 66 (1941). See Rhod. **12:** 50 (1910).

Stony ridge on mountainside northeast of our camp at Brintnell L., alt. 3700′, *9680.*

Common locally in rather dry, open spruce woods. Not previously observed in the Mackenzie basin north of Lake Athabaska (Raup, 1936, p. 192).

**Lycopodium obscurum** L. var. **dendroideum** (Michx.) D. C. Eat. in Gray, Man. ed. 6, 696 (1890); Hultén, Fl. Alaska & Yuk. Pt. 1: 69 (1941). See Rhod. **23:** 188 (1921).

*Lycopodium dendroideum* Michx. Fl. Bor.-Am. **2:** 282 (1803).

Near Norman, Mackenzie R., *Miss E. Taylor 155* (Can.).

Apparently rare in the northern part of the Mackenzie basin, though it is locally abundant about Lake Athabaska and in the southwestern sections (Raup, 1934, 1936).

**Lycopodium alpinum** L. Sp. Pl. 1104 (1753); Hultén, Fl. Alaska & Yuk. Pt. 1: 62 (1941).

East slope of Red Mt., Brintnell L. area, alt. 5000′, *9742;* west slope of Terrace Mt., alt. 4800′, *9507.*

Occasional to common at Brintnell L. on grassy slopes in the upper edge of the birch scrub and above it.

**Lycopodium complanatum** L. var. **canadense** Victorin in Contr. Lab. Bot. Univ. Montreal No. 3: 70 (1925); Hultén, Fl. Alaska & Yuk. Pt. 1: 68 (1941); Porsild in Nat. Mus. Can. Bull. **101:** 29 (1945).

Woods near Ft. Liard, *Nowosad* (Can.); thicket on hogback, north slope of Colonel Mt., alt. 4300′, *9629;* in moss-lichen mat in open spruce woods on rocky knoll near east end of Brintnell L. *9584;* open woods along Frost Creek, north of camp, alt. 3500′, *9270;* north peak of Nahanni Mt., *Wynne-Edwards 8421* (Can.).

Occasional to common in open woods and dry thickets. All of the specimens collected in the Mackenzie Mts. have the short, fruiting peduncles of var. *canadense* Victorin. Forms which should also be referred here were collected by the writer on Lake Athabaska (1936, p. 192), and by A. E. Porsild in Alaska (Rhod. **41**: 173. 1939).

## SELAGINELLACEAE

**Selaginella selaginoides** (L.) Link, Fil. Hort. Berol. 158 (1841); Hultén, Fl. Alaska & Yuk. Pt. 1: 74 (1941); Porsild in Nat. Mus. Can. Bull. **101:** 14, 30 (1945).

*Lycopodium selaginoides* L. Sp. Pl. 1101 (1753).

Mossy muskeg thickets near west end of Brintnell L., *9711;* north peak of Nahanni Mt., *Wynne-Edwards 8422* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Porsild 11827* (Can.); same, *Wynne-Edwards 8232* (Can.); Little Keele R., alt. 2200′, mi. 51 E., *Porsild 11781* (Can.); Macmillan Pass, mi. 225 E., *Porsild 11182* (Can.).

## ISOETACEAE

**Isoëtes Braunii** Dur. in Bull. Soc. Bot. France **11:** 101 (1864); Hultén, Fl. Alaska & Yuk. Pt. 1: 76 (1941). See Ann. Mo. Bot. Gard. **9:** 156–173 (1922).

This species has not yet been found in southwestern Mackenzie, but it is to be expected there. It has been collected near Lake Athabaska (*Raup & Abbe 4617*) and at Great Bear L. (*Porsild 3688*).

## PINACEAE

**Picea glauca** Voss var. **albertiana** (S. Brown) Sarg. in Bot. Gaz. **67:** 208 (1916); Porsild in Nat. Mus. Can. Bull. **101:** 14 (1945).

*Picea albertiana* S. Brown in Torreya **7:** 126 (1907).

*Pinus alba* sensu Hooker, Fl. Bor.-Am. **2:** 163 (1839), in part, non Michx.

*Picea canadensis* sensu Preble in N. A. Fauna **27:** 517 (1908), non B. S. P.

*Picea glauca* Voss, Hultén in Fl. Alaska & Yuk. Pt. 1: 80 (1941), in part.

Mackenzie R., *Onion* (N); rocky cliff along gorge east of Brintnell L., tree 10′ high, 2″ D. B. H., *9580;* stony fan at camp, Brintnell L., tree 65′ high, 14″ D. B. H., no. 9663; Sekwi R., Canol Rd., mi. 174 E., *Porsild 11972* (Can.); headwaters of Sekwi R., mi. 180 E., alt. 3900′, *Porsild 11840* (Can.).

This is the commonest tree in the Brintnell Lake region. It forms rather dense forests on the rocky talus slopes about the lake and grows abundantly on the gravelly floor of the valley west of the lake. On some rocky and sandy knolls about the eastern end it makes an open, park-like wood with a lichen-heath mat on the ground. On higher mountain slopes it extends into the alpine zone farther than any of the other trees, gradually becoming stunted and reduced to the proportions of a depressed shrub. On the north slope of Colonel Mt. it clothes the larger rocky fans with a thick timber 50 to 70 feet high, but gives way to *P. mariana* on the steeper slopes between the fans. It reappears at about 3500′, however, and makes the upper fringe of the timber, along with occasional patches of *Abies*. On the fans and south-facing slopes north of the lake it is mixed with *P. glauca* var. *Porsildii* on the drier soils, but forms nearly pure stands on moister sites such as occur at the bases of the mountains. Although tall and straight, most of the trees are spirally twisted, and many have eccentric cores especially at the base. This is due to their situation on steep slopes which are subject to land-slip and snow-slides.

*Picea glauca* var. *albertiana* is the characteristic tree over large portions of the central Mackenzie basin. It is clearly recognizable in the country immediately south of the timber line and on the foothills of the Rockies, but in the central lowlands and plateaus it appears to merge with typical *P. glauca* (see Raup, 1946, for further discussion of its distribution).

**Picea glauca** Voss var. **Porsildii** var. nov. Plate XII.

Arbor ad 15–17 m. alta habitu conica vel anguste ovata, ramis inferioribus exceptis paene horizontalibus, trunco basim versus ad 30 cm. diametro; cortice pallido-canescente fissuris paucis longitudinalibus basim arboris versus exceptis sublevi, pustulis resinosis multis ornato; ramulis glabris pallido-viridibus;

squamis gemmarum margine tenuibus laceratisque; foliis linearibus 9–22 mm. longis glauco-viridibus, sterigmatibus brevibus erectis vel satis divergentibus; conis 2.5–5 cm. longis, maturitate ad 3 cm. crassis; bracteis obovatis vel late cuneatis, apice rotundatis vel truncatis, integerrimis; squamis tenuibus, 3–4.5 mm. longis, 2 mm. latis, rotundatis, obtusis vel subdeltoideis, apice interdum emarginatis, margine laceratis.

Stony fan at Camp Point, Brintnell L., tree 35′ high, *9666* (TYPE); same, tree 55′ high, *9664;* same, tree 40′ high, *9665;* mud flat near west end of lake, tree 20′ high, 4½″ D. B. H., *9803;* near shore of Great Slave L., Hay River, *9984, 9985.*

This tree is most nearly related to *P. glauca* and its northern variety *albertiana,* and since it appears to differ from typical *P. glauca* in no essential characters of fruit, it seems best to designate it as a geographic variety. It differs from *P. glauca* var. *albertiana* chiefly in its conical or narrowly ovate outline and in its relatively smooth, balsam-like bark beset with resin blisters. Variety *albertiana* is very narrowly pyramidal or even linear in form, spire-like, and its bark is rough and flaky. At Brintnell L. the two are growing side by side on the stony fans, particularly on the north shore, and are sharply contrasted (see PL. XII). In characters of cone, branchlet, and leaf, the differences are not so apparent, although the cone-scales of var. *Porsildii* tend to be more rounded in outline, and less wedge-shaped toward the base than those of var. *albertiana;* also the bracts of the former are shorter and more angular toward the apex than in var. *albertiana.* From typical *P. glauca* it differs principally in its smooth bark and, again, in its short, angular scales (in *P. glauca* they are up to 5 mm. long).

Variety *Porsildii* is abundant on the drier mountain slopes and stony fans of southern exposure about Brintnell L. It occurs on the south shore, but only on stony fans near the water's edge. On dry talus slopes it extends up to about 4000′ north of the lake. In the neighborhood of Fort Simpson it was observed on the bluffs and uplands west of the Mackenzie River; and it also appeared to be common on the south shore of Great Slave L. at Hay River. There are two specimens in the Herbarium of the Arnold Arboretum collected by *J. G. Jack* in the Jasper Park district which match our northern material. Both have pieces of the nearly smooth bark attached. They are as follows: Athabaska R. bank, near Jasper Park Lodge, 35′ high, 5–6″ diameter, "Blisters in bark," Sept. 8, 1922, *2807;* Maligne R. above gorge, 45′ high, 6″ diameter, "Large resin blisters on bark," Sept. 4, 1922, *2719.* A third specimen, collected by Prof. Jack at Lake Beauvert, *2669,* is described as having "bark nearly smooth or but slightly scaling," but the twigs are decidedly pubescent! It is from a tree 40′ high and 8″ in diameter. No trees with pubescent twigs were found in the Mackenzie region.

*Abies balsamea* was reported on the upper Mackenzie by Richardson (Arct. Search. Exp. 2: 316), with the following statement: it ". . . was traced beyond the 62nd parallel on the canoe route." The writer has seen no specimens, however, from north of the Athabaska delta; and this is consistent with Preble's findings. It is not impossible that the Mackenzie record by Richardson was based upon observations of *P. glauca* var. *Porsildii,* the bark of which so closely resembles that of the balsam. It should be noted also that var. *Porsildii* has proved to be common along the Alaska Highway in southern Yukon and northern British Columbia.

**Picea mariana** (Mill.) B. S. P. Prel. Cat. N. Y. 71 (1888); Preble in N. Am. Fauna **27:** 518 (1908); Hultén, Fl. Alaska & Yuk. Pt. 1: 82 (1941); Porsild in Nat. Mus. Can. Bull. **101:** 14 (1945).

*Abies mariana* Mill. Gard. Dict. ed. 8, no. 5 (1768).

*Pinus nigra* sensu Hooker, Fl. Bor.-Am. **2:** 163 (1839), non Ait.

Damp mossy woods near shore of Brintnell L., tree 30′ high, 5″ D. B. H., *9565.*

Common in muskegs and low woods about Brintnell L. and ascending to about 3500′ on the steep north-facing mountain slopes just south of the lake. Here it grows in an open park-like stand with a thick mat of mosses and fruticose lichens on the ground, and a rather open shrub layer of willows and dwarf birches. At the higher levels it becomes stunted and tends to reproduce by layering, sending out numerous "branches" through the dense moss-lichen mat. Noted by Preble (1908, p. 518) ". . . northward nearly to the limit of the forest. . . ," and in Fl. Bor.-Am. (**2:** 164, as *Pinus nigra*) ". . . throughout Canada, to lat. 65°. . . ." Porsild makes the following comment on its distribution along the Canol Rd., "Noted as common on the eastern end of the road, but becoming scarce in the mountains where no extensive black spruce forest was seen. Last trees were noted on Trout Creek about mile 120 E."

**Abies lasiocarpa** (Hook.) Nutt. N. Am. Sylva **3:** 38 (1849); Hultén, Fl. Alaska & Yuk. Pt. 1: 87 (1941); Porsild in Nat. Mus. Can. Bull. **101:** 14 (1945).

*Pinus lasiocarpa* Hooker, Fl. Bor.-Am. **2:** 163 (1839).

Upper valley of Frost Cr., north of our camp at Brintnell L., alt. 4500′–4800′, small trees up to 10′ high, 2″–3″ D. B. H., *9527;* north slope of Colonel Mt., alt. about 4000′, *9376;* hogback on north slope of Colonel Mt., alt. 4200′ (bark only), *9602;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11184* (Can.).

The alpine fir as found at Brintnell Lake displays some variation from its usual form, and with further study it may justifiably be segregated as a geographic variety. It appears to differ from typical *A. lasiocarpa* in having very small cones (2.5 to 5 cm. long) with correspondingly small scales. The wings of the seeds are usually smaller, and are broader in proportion to length than in *A. lasiocarpa* ($6\frac{1}{2} \times 8\frac{3}{4}$ mm. vs. $7 \times 12$ mm.); also they are more rounded at the base, often cordate at their outer insertion on the seed, while in the typical form they are usually cuneate in outline. Leaves of the fruiting twigs are acute to rounded, or even slightly emarginate, not sharp-pointed as in the species; leaves of sterile twigs are strongly emarginate.

Common at timber line, where it is usually surrounded by the dwarf birch scrub (*Betula glandulosa*) and grows in small clumps with much dead wood in them. On high, wind-swept slopes the plants are distorted and dwarfed.

The northern limit of the range of *Abies lasiocarpa* is usually given as about lat. 61° in Alaska and Yukon (Sargent, Silva **12:** 113). There is a specimen in the Arnold Arboretum Herbarium collected by G. M. Dawson in July, 1887, and labeled, "Mts. above Finlayson." This is presumably Finlayson Lake, on the divide between the Francis and Pelly River valleys. It is in lat. 61° 40′. Dr. Dawson states (Geol. Surv. Can. **3:** 118 B, 1888), that "On the ridges west of the head of Finlayson Lake *Abies subalpina* becomes moderately abundant." Our collections, therefore, do not extend the range far northward (62° 5′), but they establish the species in the isolated Mackenzie Mountain system to the eastward.

**Larix laricina** (Du Roi) Koch var. **alaskensis** (Wight) comb. nov.

*Larix alaskensis* Wight in Smithson. Misc. Coll. **50**: 174 (1908).

*Larix laricina* sensu Porsild in Nat. Mus. Can. Bull. **101**: 14 (1945).

Muskeg at eastern end of Brintnell L., tree 20′ high, 4″ D. B. H., *9575;* Godlin R., Canol Rd., mi. 142 E., alt. 3600′, *Porsild 11839* (Can.); Twitya R., Canol Rd., mi. 124 E., *Porsild 11837* (Can.).

Common in muskegs about the eastern end of Brintnell L., but not found elsewhere in that vicinity.

*Larix alaskensis* was described by W. F. Wight (Smithson. Misc. Coll. **50**: 174, *pl. 17,* 1907) from material collected at Tanana, Alaska, by A. J. Collier. Recent students have considered it synonymous with *L. laricina* (Porsild, Contr. Fl. Alaska, Rhod. **41**: 174, 1939; Rehder, Man. Cult. Trees and Shrubs, ed. 2, p. 98, 1940), following Ostenfeld and Larsen (Kgl. Danske Videnskab. Selsk. Biol. Meddel. **9**: 85–95, 1930). The latter authors did not see the type of *L. alaskensis,* but from specimens collected at Ft. Gibbon on the Yukon R. they confirmed the characterization given by Wight: "The cone scales are longer [than in *L. laricina*] in proportion to their breadth; the bracts of the cone scales are ovate and without a projecting mucronate point at the apex, while *L. laricina* has bracts short-oblong to nearly orbicular in outline, and commonly emarginate or lacerate on either side of a mucronate projection at the apex." Ostenfeld and Larsen, however, did not believe that the characters given were sufficient to separate the northwestern plants from the typical species. They cited similar material from Lake Superior and from Churchill, Hudson Bay, stating that the *alaskensis* type would better be considered as a "form of growth."

Although he has not given it separate status, Hultén (Fl. Alaska and Yuk. Pt. 1: 79–80) recognized the existence of an Alaskan form of the American larch, and states that he has not seen any specimens of the common southern type in Alaska. I have examined a large series of specimens from most of the range of the species, as well as a part of the type of *L. alaskensis,* and have concluded that the northwestern form is at least worthy of being maintained as a geographic variety. To the differences noted by Wight should be added another: the outer margins of the bracts in typical *L. laricina* are firm, with the purplish color extending nearly or quite to the edge, while in var. *alaskensis* they are papery or chartaceous, and usually yellowish-hyaline, with a tendency to become inrolled in the mature cones. It is probably true, as Ostenfeld and Larsen have pointed out, that var. *alaskensis* will appear far eastward in the range of the species, particularly in northern latitudes. Specimens collected by the writer at Taltheilei Narrows on Great Slave L. (no. *90,* cited under *L. laricina* in Phytogeog. Studies Athab.–Great Slave L. Reg. I. p. 194) belong to it, as well as material collected on Lake Athabaska (no. *4663* l. c.) and in the Wood Buffalo Park (no. *1517,* Bot. Invest. Wood Buff. Pk. p. 98). Labrador specimens in the Gray Herbarium show the same tendency, though apparently not so marked as in those from the northwest. It is probable that far northwestern material referred to in Fl. Bor.-Am. (**2**: 164, under *Pinus microcarpa*), "From York Factory to Point Lake, in lat. 65°. . . ," also belongs here.

**Pinus Banksiana** Lamb. Pinus **1**: *pl. 3* (1803); Hooker, Fl. Bor.-Am. **2**: 161 (1839); Macoun, Cat. Can. Pl. Pt. 1: 468 (1884).

*Pinus divaricata* Du M. de C.; Preble in N. Am. Fauna **27**: 516 (1908).

Common in the central and southern parts of the Mackenzie basin (Raup, 1935, 1936, 1942), but records for the country below Great Slave L. are yet

based only upon observations. Noted in Fl. Bor.-Am. from ". . . Canada, to lat. 64°, and even beyond that, on the sandy banks of the Mackenzie River." There is a Richardson specimen in Herb. Can. (no. *25131*), but no locality is given. The species was reported by Dawson (after McConnell) on the lower Liard R. in 1887. Preble has the following notes on the northwestern extensions of the jack pine: "It occurs commonly on the Simpson Islands and about the Northern Arm of Great Slave Lake. On my route to the northward of Fort Rae it was seen in many places on Grandin River, reaching a diameter of 18 inches, but not growing very tall. North of the height of land it was rare, but I saw many trees on a portage a few miles north of the outlet of Lake Hardisty.

"On the Mackenzie it is common north to about latitude 64° 30′. . . . On the north slope of the Nahanni Mountains, 75 miles below Fort Simpson, the species ascends to about 1,000 feet and then becomes a dwarfed shrub and disappears. On the southern slopes of the same mountains it occurs as a fairly well-grown tree to about 2,000 feet, near the summit."

**Pinus contorta** Loudon var. **latifolia** Engelm. ex Wats. in King, Rep. U. S. Geol. Expl. 40th Par. **5**: 331 (1871); Hultén, Fl. Alaska & Yuk. Pt. 1: 77 (1941).

*Pinus Murrayana* Balf. Rep. Bot. Oreg. Exped. 2 (1853).

*Pinus contorta* Loudon var. *Murrayana* (Balf.) Engelm. in Wats. Bot. Calif. **2**: 126 (1880).

As noted elsewhere in this paper, the occurrence and distribution of the lodgepole pine in southwestern Mackenzie is still to be discovered. It is presumed that the lodgepole and jack pines overlap somewhere in the lower Liard country and on the foothills of the northern Rockies. Pines in the Liard valley above the "Liard Gap" all appear to be lodgepole, and it is supposed that those in the Mackenzie Mountains west of the South Nahanni R. are also of this species. No pines of any kind were seen at Brintnell L., and Porsild makes no mention of any along the Canol Road east of Macmillan Pass until he reaches the Mackenzie valley, where *Pinus Banksiana* appears.

**Juniperus communis** L. var. **montana** Ait. Hort. Kew. **3**: 414 (1788); Hultén, Fl. Alaska & Yuk. Pt. 1: 89 (1941); Porsild in Nat. Mus. Can. Bull. **101**: 30 (1945), in part; Raup in Jour. Arn. Arb. **17**: 195 (1936).

*Juniperus communis* var. *nana* Hooker, Fl. Bor.-Am. **2**: 165 (1839).

*Juniperus communis* L. sensu Porsild in Nat. Mus. Can. Bull. **101**: 14 (1945), in part.

*Juniperus nana* sensu Preble in N. Am. Fauna **27**: 519 (1908), non Willd.

Bear R., Wood Buffalo Park, *Russell 38* (G); Resolution, Great Slave L., *E. A. Preble 206* (US); Wrigley, *Crickmay 148* (Can.); hogback on north slope of Colonel Mt., Brintnell L. area, alt. 4300′, *9603;* north peak of Nahanni Mt., *Wynne-Edwards 8423* (Can.); Nahanni Mts., *Preble & Cary 68* (US).

Common on dry rocky slopes around Brintnell L. usually above timber line (between 3800′ and 4500′), where it often occurs as a primary species in the rather open communities. Noted in Fl. Bor.-Am. from Lake Huron "to the barren country of the Hudson Bay Co.'s territories." Undoubtedly common throughout southwestern Mackenzie, though collections of it are rare. Porsild noted it as common in many places along the Canol Rd.

**Juniperus horizontalis** Moench. Meth. 699 (1794); Hultén, Fl. Alaska & Yuk. Pt. 1: 91 (1941); Porsild in Nat. Mus. Can. Bull. **101**: 30 (1945).

*Juniperus sabina* sensu Preble in N. Am. Fauna **27**: 519 (1908), non L.

Wrigley, *Crickmay 149* (Can.); north peak of Nahanni Mt., *Wynne-Edwards 8424* (Can.); Nahanni Mt., *Preble & Cary 73* (US).

Preble states that this species extends "throughout the forested belt," but the above are the only specimens I have seen from below Great Slave L.

## TYPHACEAE

**Typha latifolia** L. Sp. Pl. 971 (1753); Hooker, Fl. Bor.-Am. **2**: 170 (1839); Macoun, Cat. Can. Pl. Pt. 4: 69 (1888).

Although this species is noted in Fl. Bor.-Am. as occurring "Throughout Canada to Fort Franklin," there is no other evidence of its presence on the upper Mackenzie. It is common, however, in the Wood Buffalo Park and is to be expected around the western arm of Great Slave L.

## SPARGANIACEAE

**Sparganium eurycarpum** Engelm. in Gray, Man. ed. 2, 430 (1856); Porsild in Sargentia **4**: 9 (1943). See Rhod. **24**: 26 (1922).

Common at the margins of ponds and slow streams in the Athabaska–Peace delta region, and collected by Porsild along the Mackenzie R. near Norman. It probably occurs at least sporadically throughout the upper Mackenzie lowland.

**Sparganium multipedunculatum** (Morong) Rydb. in Bull. Torr. Bot. Cl. **32**: 598 (1905); Raup in Jour. Arn. Arb. **17**: 195 (1936). See Rhod. **27**: 190 (1925).

*Sparganium simplex* var. *multipedunculatum* Morong in Bull. Torr. Bot. Cl. **15**: 79 (1888).

*Sparganium simplex* sensu Hooker, Fl. Bor.-Am. **2**: 169 (1839), in part; Macoun, Cat. Can. Pl. Pt. 4: 70 (1888) in part; non Huds.

Fort Franklin, Mackenzie R., *Richardson* (N).

Common in the central and southern parts of the Mackenzie basin, and noted in Fl. Bor.-Am. "Throughout Canada to Fort Franklin, abundant." No material is yet available, however, from Great Slave L. or the upper Mackenzie valley.

**Sparganium angustifolium** Michx. Fl. Bor.-Am. **2**: 189 (1803); Raup in Jour. Arn. Arb. **17**: 196 (1936); Hultén, Fl. Alaska & Yuk. Pt. 1: 92 (1941); Porsild in Sargentia **4**: 8 (1943).

Locally abundant in ponds and slow streams in the Athabaska–Great Slave L. region, and collected by Porsild at Great Bear L. and in the Eskimo Lakes basin. Probably widespread in the upper Mackenzie valley, though no specimens are available.

**Sparganium minimum** Fries, Summa Veg. Scand. **2**: 560 (1849); Hultén, Fl. Alaska & Yuk. Pt. 1: 94 (1941).

Mackenzie R., *Onion* (N).

The above specimen constitutes the only record for the species north of Lake Athabaska, where it is common. The actual locality of the Mackenzie collection is unknown.

## POTAMOGETONACEAE

**Potamogeton filiformis** Pers. var. **borealis** (Raf.) St. John in Rhod. **18**: 134 (1916); Raup in Jour. Arn. Arb. **17**: 198 (1936); Hultén, Fl. Alaska & Yuk. Pt. 1: 99 (1941).

*Potamogeton borealis* Raf. Med. Repos. **2**: 354 (1808).

Northwest shore of Great Slave L., *Bedford* (Can.).

**Potamogeton vaginatus** Turcz. in Bull. Soc. Nat. Hist. Mosc. **11:** 102 (1838); Hultén, Fl. Alaska & Yuk. Pt. 1: 104 (1941). See Rhod. **18:** 131 (1916) and **20:** 191 (1918).

Though not yet collected in our region, this species is very common in the Wood Buffalo Park area and has been collected at Great Bear L. (*Porsild,* G).

**Potamogeton pectinatus** L. Sp. Pl. 127 (1753); Hultén, Fl. Alaska & Yuk. Pt. 1: 101 (1941).

Shallow water at lower end of Bluefish Island, Mackenzie R., near Simpson *9958, 9960.*

Abundant in this situation, and probably widespread in the Mackenzie valley. Collected by Porsild in the Mackenzie delta (*6913, 6915, 7244,* Can.).

**Potamogeton foliosus** Raf. var. **macellus** Fernald in Mem. Gray Herb. **3:** 46 (1932).

Collected in the Wood Buffalo Park (Raup *1562, 132, 1561*) and at Great Bear L. (*A. E. & R. T. Porsild*), but not yet found on the upper Mackenzie.

**Potamogeton Friesii** Rupr. Beitr. Russ. Reich. **4:** 43 (1845); Fernald in Mem. Gray Herb. **3:** 52 (1932); Hultén, Fl. Alaska & Yuk. Pt. 1: 99 (1941).

Not yet collected along the upper Mackenzie, but known in the Wood Buffalo Park (*Raup 1564*) and at Great Bear L. (*A. E. & R. T. Porsild* Can., G).

**Potamogeton alpinus** Balbis var. **tenuifolius** (Raf.) Ogden in Contr. Gray Herb. **147:** 90 (1943).

*Potamogeton tenuifolius* Raf. Med. Repos. Lex. **3, 2:** 409 (1811).

*Potamogeton alpinus* Balbis ssp. *tenuifolius* (Raf.) Hultén, Fl. Alaska & Yuk. Pt. 1: 98 (1941).

This species has been collected in the Athabaska–Great Slave L. region (*Raup 6498a, 6618, 6621, 6622, 6741, 6742*), at Great Bear L. (*A. E. & R. T. Porsild*), and in the Eskimo Lakes basin (*A. E. & R. T. Porsild*), but it has not yet been observed on the upper Mackenzie.

**Potamogeton gramineus** L. var. **typicus** Ogden in Contr. Gray Herb. **147:** 143 (1943); Hultén, Fl. Alaska & Yuk. Pt. 1: 100 (1941).

*Potamogeton gramineus* L. var. *graminifolius* Fries, Novit. Fl. Suecicae 36 (1828); Raup in Jour. Arn. Arb. **17:** 196 (1936).

Northwest shore of Great Slave L., *Bedford* (Can.); margin of lowland slough near west bank of Mackenzie R. near Fort Simpson, *9894.*

Sterile plants only, creeping on damp muck, collected Aug. 24. Common in this situation, but not seen elsewhere in our region. Common in the Wood Buffalo Park, and collected at Great Bear L. by *A. E. & R. T. Porsild.*

**Potamogeton gramineus** L. var. **maximus** Morong ex Bennett in Jour. Bot. **19:** 241 (1881). See Ogden in Contr. Gray Herb. **147:** 148 (1943).

Known in the Wood Buffalo Park (*Raup 1546, 1548*) and at Great Bear L. (*A. E. & R. T. Porsild*), but not yet found on the upper Mackenzie.

**Potamogeton praelongus** Wulf. in Arch. Bot. Roem. 3: 331 (1805); Raup in Jour. Arn. Arb. **17:** 197 (1936); Hultén, Fl. Alaska & Yuk. Pt. 1: 103 (1941). See Ogden in Contr. Gray Herb. **147:** 159 (1943).

Common in the Athabaska–Great Slave L. region (*Raup 1570, 1571, 1572, 133*), and found in the Eskimo Lakes basin (*A. E. & R. T. Porsild*), but not yet collected on the upper Mackenzie.

**Potamogeton Richardsonii** (Bennett) Rydb. in Bull. Torr. Bot. Cl. **32:** 599 (1905); Raup in Jour. Arn. Arb. **17:** 197 (1936).

*Potamogeton perfoliatus* var. *Richardsonii* Bennett in Jour. Bot. **27:** 25 (1889).

*Potamogeton perfoliatus* ssp. *Richardsonii* (Bennett) Hultén, Fl. Alaska & Yuk. Pt. 1: 102 (1941).

Northwest shore of Great Slave L., *Bedford* (Can.); Ft. Rae, *Bedford* (Can.); shallow water at lower end of Bluefish Island, Mackenzie R. near Simpson, *9959;* Liard R., between Nahanni Butte and Simpson, *Crickmay 5* (Can.).

Common at the Bluefish Island station. In fruit late in August.

## SCHEUCHZERIACEAE

**Triglochin maritimum** L. Sp. Pl. 339 (1753); Hooker, Fl. Bor.-Am. **2:** 168 (1839); Raup in Jour. Arn. Arb. **17:** 198 (1936); Hultén, Fl. Alaska & Yuk. Pt. 1: 105 (1941).

North of the height of land between Great Slave and Great Bear Lakes, *Bedford* (Can.).

Noted by Hooker from "Cumberland House Fort . . . to the Mackenzie River"; and there is a specimen in Herb. N collected by *Onion* which probably came from the Mackenzie, though it is without locality data. Collected by *A. E. & R. T. Porsild* at Great Bear L. (*3261, 3671, 4664, 5089, 5165*) and in the Mackenzie delta (*1899, 2301*).

**Triglochin palustre** L. Sp. Pl. 338 (1753); Hultén, Fl. Alaska & Yuk. Pt. 1: 106 (1941); Porsild in Nat. Mus. Can. Bull. **101:** 33 (1945).

Rocky-sandy bank of Mackenzie R., opposite Simpson, *9951;* shore of Mackenzie R. 10 mi. below Mills L., *Wynne-Edwards 8545* (Can.).

Occasional; found fruiting late in August.

## ALISMACEAE

**Sagittaria cuneata** Sheldon in Bull. Torr. Bot. Cl. **20:** 283 (1893); Raup in Jour. Arn. Arb. **17:** 198 (1936).

Northwest shore of Great Slave L., *Bedford* (Can.).

## GRAMINEAE

**Bromus ciliatus** L. Sp. Pl. 76 (1753); Raup in Jour. Arn. Arb. **17:** 199 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 249 (1942).

*Bromus purgans* L. var. *vulgaris* Hooker, Fl. Bor.-Am. **2:** 252 (1840), in part.

Resolution, *Kennicott* (N); Fort Norman, *Richardson* (G).

**Bromus Pumpellianus** Scribn. in Bull. Torr. Bot. Cl. **15:** 9 (1888); Hultén. Fl. Alaska & Yuk. Pt. 2: 251 (1942); Porsild in Nat. Mus. Can. Bull. **101:** 34 (1945). See Porsild in Rhod. **41:** 182–183 (1939).

Upland woods west of the Mackenzie R. near Simpson, *9935;* Saline R., above Norman, *Wynne-Edwards 8567* (Can.).

Common; spikelets maturing late in August. Some of the glumes on these specimens are hairy, suggesting var. *arcticus* (Shear) Porsild (l. c.), but other characters of this variety, such as very hairy sheaths and upper leaf-surfaces, are absent.

**Festuca brachyphylla** Schultes, Mant. **3** (Add. 1): 646 (1827); Hultén, Fl. Alaska & Yuk. Pt. 2: 241 (1942); Porsild in Nat. Mus. Can. Bull. **101:** 15 (1945). See Fernald in Rhod. **37:** 250–252 (1935).

Stony beach at Camp Pt., Brintnell L., *9176;* gravelly thickets near lake shore at Camp Pt., *9368;* dry sandy plain near west end of Brintnell L., *9451;* shaly south slope of Terrace Mt., alt. 4000′–5000′, *9669, 9678;* turfy ledges on summit of Red. Mt., alt. 5900′, *9771;* shale slopes on south side of Red Mt., alt. 5000′, *9783;* shale cliffs in gorge on north slope of Colonel Mt., alt. 3500′, *9822;* Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8237* (Can.).

Occasional to common locally; in anthesis late in June, and mature in August. This species is one of the principal ones forming the open association on the very

summit of Red Mt. It was not seen on Colonel Mt., however, except in the deep gorge on the lower north slope.

**Festuca rubra** L. Sp. Pl. 74 (1753); Raup in Jour. Arn. Arb. **17:** 199 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 244 (1942). See Rhod. **35:** 132–135 (1933).

This species has not been collected on the upper Mackenzie, but it is known from Lake Athabaska (*Raup 6723A, 6905, 6941A*) and at Great Bear L. (*J. M. Bell,* Can.).

**Festuca rubra** L. var. **arenaria** (Osbeck) Fries, Fl. Hall. 28 (1817); Raup in Jour. Arn. Arb. **17:** 199 (1936). See Rhod. **35:** 132–135 (1933).

*Festuca arenaria* Osbeck in Retz. Sup. Prodr. Fl. Scand. 1: 4 (1805).

Like the last, this variety is known at Lake Athabaska (*Raup 171, 4432, 4573, 6713, 6723, 6900, 6941*), and at Great Bear L. and the arctic coast (*Richardson,* G), but has not yet been collected between.

**Festuca saximontana** Rydb. in Bull. Torr. Bot. Cl. **36:** 536 (1909); Raup in Jour. Arn. Arb. **17:** 199 (1936). See Rhod. **37:** 250–252 (1935).

*Festuca ovina* sensu Hooker, Fl. Bor.-Am. **2:** 250 (1840), in part; Macoun, Cat. Can. Pl. Pt. 4: 235 (1888), in part, non L.

*Festuca brachyphylla* Schultes ssp. *saximontana* (Rydb.) Hultén, Fl. Alaska & Yuk. Pt. 2: 242 (1942).

Common in the Athabaska–Great Slave Lake region and far northward, though no material is yet available from the upper Mackenzie region. Noted in Fl. Bor.-Am. northward ". . . to Bear Lake," and there are Richardson specimens from the latter place in Herbs. G and N.

**Festuca altaica** Trin. in Ledeb. Fl. Alt. **1:** 109 (1892); Hultén, Fl. Alaska & Yuk. Pt. 2: 239 (1942); Porsild in Nat. Mus. Can. Bull. **101:** 15 (1945).

Mackenzie R., Wrigley to Blackwater R., *Crickmay,* no. *127* (Can.); and from Blackwater to Norman, *Crickmay,* no. *154* (Can.); along small brook on east slope of Red Mt., alt. 4500′, *9278;* alpine meadows and scrub on north slope of Colonel Mt., alt. 4000′–6000′, *9396, 9615;* open spruce woods on rocky knoll near east end of Brintnell L., *9576;* turfy ledges on summit of Red Mt., alt. 5900′, *9792;* Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8236* (Can.).

Abundant above timber line, and occasional at lower elevations; in anthesis late in June. This is one of the most abundant grasses in the Brintnell L. district. It is a primary species in most of the alpine meadows, where it is made conspicuous, even at a distance, by its habit of forming large tussocks in which there remain a great many dry dead leaves. Its tall culms and panicles are often dark purplish red. The lemmas of our plants are very scabrous, almost hairy, thus resembling those of Alaskan specimens rather than those of northern Rocky Mt. material. Plants from the upper Peace R. Rockies (*Raup & Abbe,* no. *3956*) have nearly smooth lemmas. Porsild states that *Festuca altaica* is a dominant species in Macmillan Pass.

**Glyceria grandis** Wats. in Gray, Man. ed. 6: 667 (1890).

*Glyceria maxima* (Hartm.) Holmb. ssp. *grandis* (Wats.) Hultén, Fl. Alaska & Yuk. Pt. 2: 229 (1942).

Resolution, *Kennicott* (N).

**Glyceria pulchella** (Nash) K. Schum. in Just, Bot. Jahresb. **29**, Pt. 1: 513 (1903); Raup in Nat. Mus. Can. Bull. **74:** 103 (1935); Hultén, Fl. Alaska & Yuk. Pt. 2: 232 (1942).

*Panicularia pulchella* Nash in Bull. N. Y. Bot. Gard. **2:** 157 (1901).

Along the lower little Buffalo R., *Russell 44* (G); damp slough in lowland woods near Simpson, *9840;* grassy swale near Ft. Liard, *Nowosad* (Can.).

Common in the Simpson habitat; spikelets mature in the latter part of August. Not previously noted in the Mackenzie basin north of the Wood Buffalo Park.

**Puccinellia Nuttalliana** (Schult.) Hitchc. in Jepson, Fl. Calif. **1:** 162 (1912); Raup in Jour. Arn. Arb. **17:** 200 (1936).

*Poa Nuttalliana* Schult. Mant. **2:** 303 (1824).

*Poa airoides* Nutt.; Hooker, Fl. Bor.-Am. **2:** 245 (1840).

Great Slave L., *Richardson* (G); southwest and north shores of Great Slave L., *Howe 91994* (Can.).

**Puccinellia Vahliana** (Liebm.) Scribn. & Merrill in Contr. U. S. Nat. Herb. **13:** 78 (1910); Porsild in Nat. Mus. Can. Bull. **101:** 15 (1945).

*Poa Vahliana* Liebm. in Fl. Dan. *tab. 2401* (1845).

Plains of Abraham, Canol Rd., mi. 82 E., on bald, wind swept summit of limestone mountain, alt. 6000′, in wet clay and limestone rubble, *Porsild 11787* (Can.).

**Poa alpina** L. Sp. Pl. 67 (1753); Hooker, Fl. Bor.-Am. **2:** 246 (1840); Macoun, Cat. Can. Pl. Pt. 4: 222 (1888); Raup in Jour. Arn. Arb. **17:** 201 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 198 (1942); Porsild in Nat. Mus. Can. Bull. **101:** 15 (1945).

Mackenzie R., between Blackwater R. and Norman, *Crickmay 155* (Can.); stony lake shores at Brintnell L. Camp, *9168, 9572;* high shale slopes and summit of Red Mt., alt. 5000′–5900′, *9781;* creviced shale cliffs, north slope of Colonel Mt., *9606;* damp mossy slopes on old slide-rock, gorge on north slope of Colonel Mt., alt. 3200′, *9824;* open spruce woods on a stony fan, south shore of Brintnell L., *9828;* Bolstead Cr., Canol Rd., mi. 111 E., wet alpine meadow, alt. 5500′, *Wynne-Edwards 8239* (Can.); same loc., alpine slope, *8238* (Can.); noted by Porsild as common in Macmillan Pass, mi. 225 E.

Common above timber line, and occasional on gravelly lake shores; found in anthesis about mid-June, and occasionally as late as mid-August. Extremely variable in habit, especially at the lower elevations. Noted in Fl. Bor.-Am., "From the elevated grounds of the Saskatchewan . . . to Bear Lake. . . ."

**Poa pratensis** L. Sp. Pl. 67 (1753); Hooker, Fl. Bor.-Am. **2:** 246 (1840); Raup in Jour. Arn. Arb. **17:** 201 (1936).

*Poa alpigena* (Fr.) Lindm., sensu Hultén, Fl. Alaska & Yuk. Pt. 2: 197 (1942), in part; Porsild in Nat. Mus. Can. Bull. **101:** 15 (1945).

East shore of Trout L., *C. O. Hage* (G); top of river bluff at Simpson, *9121;* cleared field at Simpson, *9141;* damp thickets west of Simpson, *9839, 9849;* upland prairie west of Simpson, *9898;* gravelly willow-alder thickets along shore at Brintnell L. Camp, *9465, 9467;* damp stony beaches at Brintnell L. Camp, *9166;* mossy shore of old stream channel at west end of Brintnell L., *9495;* damp mud flats near mouth of glacial stream at west end of Brintnell L., *9689;* noted by Porsild in a number of places along the Canol Road between Macmillan Pass and Norman.

Occasional to common in the habitats cited above; in anthesis about mid-June at Simpson, but not until the second week in July at Brintnell L. Noted in Fl. Bor.-Am. from "Saskatchewan to Bear Lake."

I am here considering *Poa pratensis* in its broad sense, including the northern forms that have been called *P. alpigena* or *P. pratensis* var. *alpigena.* The material that I have seen from southwestern Mackenzie is extremely variable, and I have been unable to break it down satisfactorily into more than one entity, or successfully to separate any of it from the common *Poa pratensis* of the central and southern parts of the Mackenzie basin. If such a separation were made it would be on artificial grounds.

Hultén evidently regards nearly all *pratensis*-like *Poa* in Alaska and Yukon as *P. alpigena,* but notes (l. c. 198) that wherever other types in this group occur

"there seem to exist all kinds of intermediate forms." True *Poa pratensis* he regards as an introduced plant along the coasts (l. c. 219).

*Poa pratensis* is common throughout the central and southern parts of the Mackenzie basin, in a variety of forms that merge imperceptibly with those of the northern Great Plains. It is hardly conceivable that it is an introduced plant in the Athabaska–Great Slave L. region. It is frequent in several habitats, but has its greatest development in the wild upland prairies of the Wood Buffalo Park. To consider it as introduced into these prairies would be to single it out artificially and unjustifiably from the otherwise entirely native flora. The material from southwestern Mackenzie seems to me to contain only variants in this highly complex native population of *pratensis*-like forms. If a *Poa alpigena* exists in the far northwest I suspect that it is connected with *Poa pratensis* in the upper Yukon and Liard R. regions in such a way as to make it inseparable as anything more than a variety.

It is of interest that Polunin (Nat. Mus. Can. Bull. **92**: 73, 1940) arrived at a similar conclusion with regard to eastern arctic *Poa pratensis*. There also he found himself unable to effect a separation of *Poa alpigena* from the mass of material as a whole.

Number *9121* of our collections at Simpson is worthy of remark. It was collected from a "turf" on the much-frequented river bluff at Simpson. Here it is grazed repeatedly and has a depauperate habit, with culms only 4–10 inches tall, and with short, spreading leaves mostly rising from the base.

**Poa arctica** R. Br. in Suppl. App. Parry's 1st Voy. 288 (mispaged 188) (1824); Hooker, Fl. Bor.-Am. **2**: 246 (1840); Hultén, Fl. Alaska & Yuk. Pt. 2: 201 (1942); Porsild in Nat. Mus. Can. Bull. **101**: 15 (1945).

*Poa flexuosa* sensu Hooker, Fl. Bor.-Am. **2**: 245 (1840), in part, non Wahl.

*Poa cenisia* sensu Macoun, Cat. Can. Pl. Pt. 4: 224 (1888), non All.

Gravelly thickets on shore of Brintnell L. at Camp Pt., *9177, 9178, 9469;* dry shale slopes on south side of Red Mt., alt. 5000′, *9747, 9782;* in willow-birch scrub, upper valley of Frost Cr., north of Brintnell L. Camp, alt. 4000′, *9532;* turfy ledges on summit of Red Mt., alt. 5900′, *9796, 9797, 9798, 9799;* dry gravelly watercourse on N. slope of Colonel Mt., alt. 5000′, *9621;* Bolstead Cr., Canol Rd., mi. 111 E., alpine slope, alt. 5500′, *Wynne-Edwards 8240, 8241* (Can.); noted by Porsild as common in Macmillan Pass, Canol Rd., mi. 225 E.

Occasional to common in the habitats noted, except on the summit of Red Mt., where it is abundant as a primary species on some of the turfy ledges. Collected in anthesis on the lake shore as early as June 20, and on the mountain summit as late as Aug. 7. Noted in Fl. Bor.-Am. as occurring from the "Rocky Mountains to the Arctic Sea-shores and Islands in every direction." At least a part of the material cited in Fl. Bor.-Am. under *P. flexuosa* belongs here.

Extremely variable in size and habit, but fairly consistent as a species throughout our collections. All of our material appears to represent ssp. *Williamsii* (Nash) Hultén, Fl. Alaska & Yuk. Pt. 2: 202 (1942). This subspecies, however, seems to me of doubtful significance when the great variability of *P. arctica* in the distinguishing characters throughout its range is considered. For discussions of this variability see Hultén, l. c., and Polunin in Bot. Can. E. Arct. 71–72.

**Poa Brintnellii** sp. nov. Fig. 11.

Gramen perenne 5–8 dm. altum, rhizomatibus bene evolutis; inflorescentia late pyramidata 6–12 cm. longa, diffusa, ramulis inferioribus plerumque binis, ramis apice vel apicem versus tantummodo spiculiferis; culmis et inflorescentiis glabris flexuosis; laminis 1.5–2.5 mm. latis ad 25 cm. longis, planis, laxis, superioribus

brevibus (3 cm. longis), ligulis 1–2 mm. longis rotundatis, vaginis minute asperatis; spiculis 6–7 mm. longis, 2.5–3 mm. latis, basi acutis, gluma prima 3 mm. longa, secunda 4 mm. longa, lemmate 4.5 mm. longo ovato-oblongo acuto purpurascente scabro 5-nervio, nervis mediis et lateralibus lanatis, internervis glabris, nervis intermediis satis conspicuis, lemmate basi arachnoideo; antheris 2 mm. longis.

Open spruce woods on stony fan, south shore of Brintnell L., *9827* (TYPE); mossy banks on an old shale slide in gorge, north slope of Colonel Mt., alt. 3300′, *9830*. Common in the habitats noted; spikelets maturing about mid-August.

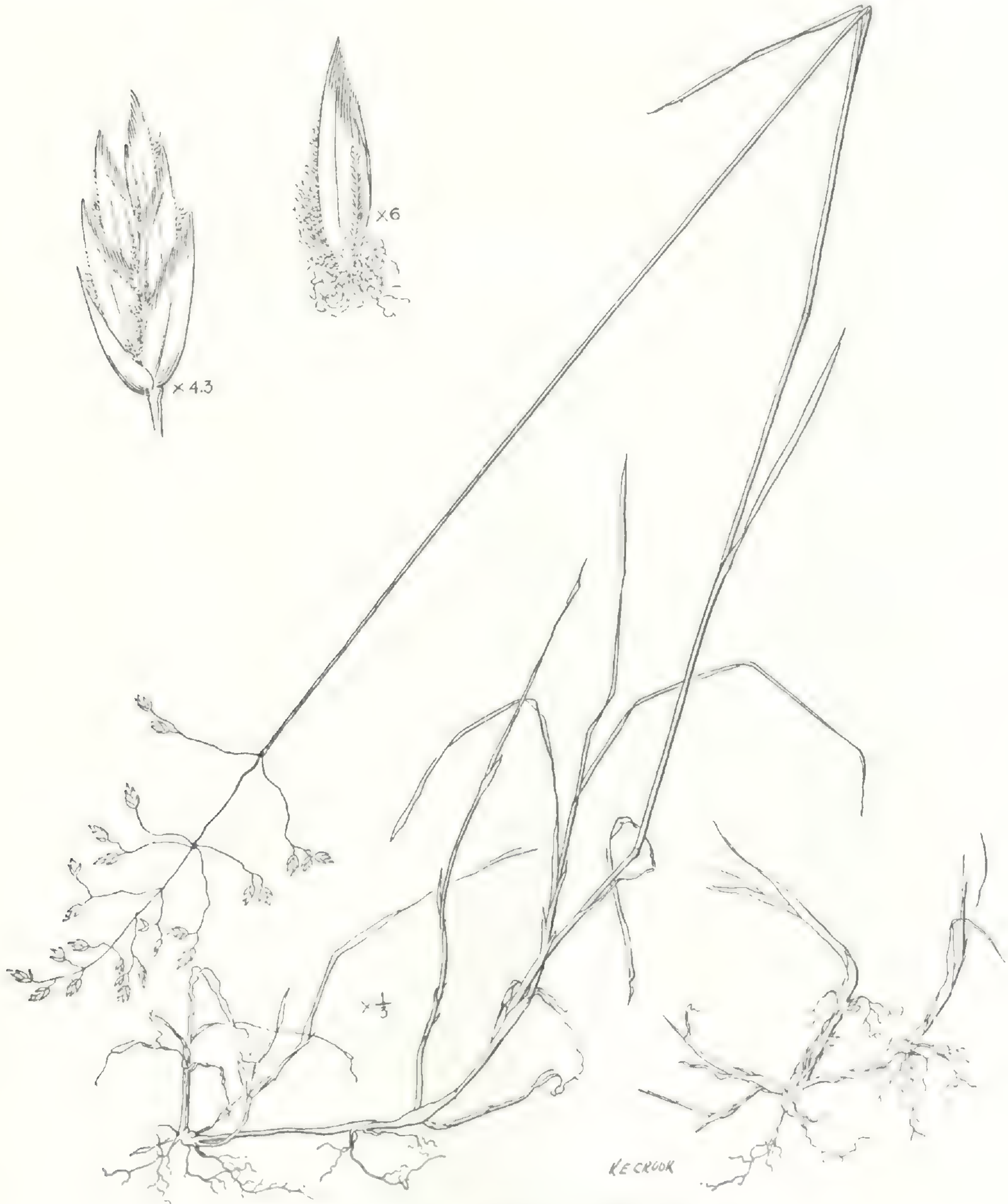


FIG. 11. *Poa Brintnellii* Raup, sp. nov.

Judging by its well-developed rhizomes this plant is in the section *Pratenses* and seems nearest to *P. arctica,* which has a spreading inflorescence with spikelets only at or near the tips of the branches. However, its glabrous internerves, rather prominent intermediate nerves (especially in mature specimens), and its

tall sprangling habit distinguish it from *P. arctica.* Also the bases of spikelets are not so much rounded as in *P. arctica.* In spikelet characters it somewhat resembles *P. paucispicula* or *P. leptocoma,* but neither of these produces such prominent rhizomes. Its inflorescence also resembles that of *P. nervosa,* but the latter has no cobweb at the base of the lemma. Hultén has described a *Poa arctica* ssp. *longiculmis,* in Fl. Alaska & Yuk. Pt. 2: 202 (1942), which has a tall slender habit of growth. His plants have closely involute basal leaves, however, and the lemmas are somewhat hairy.

**Poa palustris** L. Syst. Nat. ed. 10, **2:** 874 (1759); Hultén, Fl. Alaska & Yuk. Pt. 2: 218 (1942). See Rhod. **18:** 235 (1916).

Common in an upland prairie west of Simpson, *9896;* grassy swale near Ft. Liard, *Nowosad* (Can.).

**Poa nemoralis** L. Sp. Pl. 69 (1753); Hultén, Fl. Alaska & Yuk. Pt. 2, 217 (1942).

Dry open woods on south-facing slope of Red Mt., above Brintnell L. Camp, alt. 3500′, *9676.*

Common in places, but not widely distributed in the Brintnell L. area. Spikelets maturing early in August.

**Poa leptocoma** Trin. in Mém. Acad. St. Pétersb. VI. Math. Phys. Nat. **1:** 374 (1830); Hultén, Fl. Alaska & Yuk. Pt. 2: 215 (1942).

Mackenzie R., between Blackwater R. and Norman, *Crickmay 153* (Can.); and between Wrigley and Blackwater R., *Crickmay 126* (Can.).

**Poa paucispicula** Scribn. & Merrill in Contr. U. S. Nat. Herb. **13:** 69 (1910).

*Poa leptocoma* sensu Porsild in Nat. Mus. Can. Bull. **101:** 15 (1945), non Trin.

Damp stony and sandy beaches near Brintnell L. Camp, *9171, 9674;* shale cliffs and slide-rock on the summit of Red Mt., alt. 5900′, *9768;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11194-A* (Can.).

Occasional to common in the habitats noted, but not seen elsewhere; in anthesis late in June.

This species was originally described from Alaskan material collected by Coville & Kearney at Yakutat Bay. Scribner and Merrill considered it to be most closely related to *P. cenisia* All., in the section *Pratenses,* but Hitchcock (Man. Gr. 120–121) has probably placed it more correctly in the section *Palustres,* near *P. leptocoma* Trin. Hultén, in his Fl. Aleut. Isls. 87, has, in fact, reduced it to *P. leptocoma,* considering, incorrectly I think, that it is only a lower-growing alpine form of the latter (see also Hultén, Fl. Alaska & Yuk. Pt. 2: 215–216, 1942). *Poa leptocoma* was described from material collected at Sitka by Mertens, but its range, according to Hitchcock's interpretation, is much more southern than *P. paucispicula,* reaching to New Mexico and California. Fragments of the type of *P. leptocoma* were seen by Scribner and Merrill, and presumably by Hitchcock, at the U. S. National Herbarium and at the Missouri Botanical Garden; and Scribner and Merrill related it to *P. reflexa.* Alaskan and northern cordilleran specimens, as well as our own, have the oblong, obtuse, purplish lemmas and rather broad spikelets of *P. paucispicula.* In *P. leptocoma* (sensu Hitchc.) the spikelets are narrower, with acuminate lemmas; and in Gray Herbarium specimens the spikelets are greenish and not so much confined to the ends of the inflorescence branches as in *P. paucispicula.* With these things in view it seems best to maintain *P. paucispicula* as a distinct species representing the group of *Poa* which has short rootstocks but lacks the long creeping rhizomes of the *Pratenses.* In its inflorescence it shows the same

tendency toward reduction in the number of spikelets and their concentration toward the ends of the branches that is seen in the *P. arctica* complex in the section *Pratenses*.

**Poa glauca** Vahl in Fl. Dan. *tab. 964* (1790); Raup in Jour. Arn. Arb. **17:** 201 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 208 (1942); Porsild in Nat. Mus. Can. Bull. **101:** 15 (1945).

*Poa laxa* sensu Hooker, Fl. Bor.-Am. **2:** 246 (1840), in part, non Haenke.

Top of river bluff at Simpson, *9120;* dry southerly slope in abandoned field, Simpson, *9137, 9138, 9139;* rocky-sandy shore of Mackenzie R., opposite Simpson, *9967, 9968;* Mackenzie R., between Blackwater R. and Norman, *Crickmay 152* (Can.); Norman, *Richardson* (G, N); damp stony shores and gravelly thickets at Brintnell L. Camp, *9166-A, 9470;* muskeg thicket at west end of Brintnell L., ? *9710* (fragment); ledges on shale cliffs in gorge east of Brintnell L., *9582;* shale slopes on south side of Red Mt., alt. 5000′–5500′, *9775, 9784, 9794;* shale cliffs in gorge on north slope of Colonel Mt., alt. 3500′, *9833;* Bolstead Cr., Canol Rd., mi. 111 E., alpine slope, alt. 5500′, *Wynne-Edwards 8242* (Can.).

Occasional to common, usually in dry exposed places. It is abundant in clearings and on river banks around Simpson. In early anthesis about mid-June. Material cited in Fl. Bor.-Am. as *P. laxa,* at least in part, from "Hudson's Bay to the Arctic Islands," belongs here.

**Poa Buckleyana** Nash in Bull. Torr. Bot. Cl. **22:** 465 (1895).

East shore of Trout L., *C. O. Hage* (G); southerly slope of Red Mt., alt. 3500′–4000′, *9668, 9776;* dry stony ridge on south slope of Terrace Mt., alt. 4000′, *9670.*

Occasional to common in the upper edge of the timber on these warm south slopes, but not seen elsewhere in the region; in anthesis early in August. The Brintnell Lake plants have nearly smooth sheaths, and lemmas almost smooth except for a thin pubescence near the base and on the nerves. The lower parts of the plants as well as the spikelets are quite glaucous, so that they have a visible "bloom" on them. Hitchcock (Man. Gr., 936) reduces *P. Buckleyana* to *P. scabrella* (Thurb.) Benth., but the nearly smooth sheaths and lemmas of our plants seem to justify maintaining it. *Poa Buckleyana* has not been previously noted in the Mackenzie basin north of Lake Athabaska.

**Schizachne purpurascens** (Torr.) Swallen in Jour. Wash. Acad. Sci. **18:** 204, *fig. 1* (1928); Hultén, Fl. Alaska & Yuk. Pt. 2: 193 (1942).

*Trisetum purpurascens* Torr. Fl. N. and Mid. U. S. **1:** 127 (1823).

Grassy swale near Ft. Liard, *Nowosad* (Can.).

This species has been collected only once in the upper Mackenzie region, though it is common in the Wood Buffalo Park (Raup in Nat. Mus. Can. Bull. **74:** 105, 1935) and has been found at Great Bear L. (*Porsild 3643*).

**Agropyron trachycaulum** (Link) Malte var. **typicum** Fernald in Rhod. **35:** 169 (1933); Raup in Jour. Arn. Arb. **17:** 202 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 262 (1942). See Fernald in Rhod. **35:** 161–182 (1933) and **36:** 417 (1934) for discussion of this and the following forms of *A. trachycaulum.*

*Triticum trachycaulum* Link, Hort. Bot. Berol. **2:** 189 (1833).

Sand bars along Mackenzie R. west of Simpson, *9869;* thickets along wood road near Simpson, *9872;* rocky-sandy bank of Mackenzie R. opposite Simpson, *9969;* Norman, *Richardson* (G).

Occasional to common in the Simpson district; spikelets maturing late in August.

It is notable that *A. trachycaulum,* so far as is known at present, is represented in the Mackenzie R. district east of the mountains only by the typical form.

In the Brintnell L. region of the Mackenzie Mts. it is represented only by vars. *novae-angliae* and *unilaterale,* as follows.

**Agropyron trachycaulum** (Link) Malte var. **novae-angliae** (Scribn.) Fernald in Rhod. **35:** 174 (1933).

*Agropyron novae-angliae* Scribn. in Brainerd, Jones & Eggleston, Fl. Vermont, 9, 103 (1900).

Saline R., above Norman, *Wynne-Edwards 8569* (Can.); along dry rocky gully on south-facing slope of granite mountain just west of Brintnell L., alt. about 3000′, *9486;* thickets on north shore of Brintnell L. near camp, *9599;* muddy bank of creek entering west end of Brintnell L., *9697;* warm, shaly south slope of Red Mt., in upper part of timber, alt. 4000′, *9779.*

Occasional to common, mostly at or near lake-level; in anthesis about mid-July. Variety *novae-angliae* has not thus far been reported north of the upper Peace R. region in the Rocky Mts., and has not been noted at all in the Mackenzie basin east of the mountains.

**Agropyron trachycaulum** (Link) Malte var. **unilaterale** (Cassidy) Malte in Nat. Mus. Can. Ann. Rept. **1930:** 46 (1932).

*Agropyron unilaterale* Cassidy in Colo. State Agric. Coll. Exp. Sta. Bull. **12:** 63 (1890).

*Agropyron subsecundum* (Link) Hitchc.; Hultén, Fl. Alaska & Yuk. Pt. 2: 261 (1942).

Muddy bank of creek entering west end of Brintnell L., *9699.*

Common here, but not seen elsewhere in the Brintnell L. region; in anthesis early in August. Probably common also in the upper Mackenzie valley, though it has not yet been collected there. Frequent in the Wood Buffalo Park.

**Agropyron latiglume** (Scribn. & Sm.) Rydb. in Bull. Torr. Bot. Cl. **36:** 539 (1909); Hultén, Fl. Alaska & Yuk. Pt. 2: 258 (1942); Porsild in Nat. Mus. Can. Bull. **101**: 15 (1945). See Malte in Nat. Mus. Can. Ann. Rept. **1930**: 27–48 (1932), and Fernald in Rhod. **35:** 169 (1933).

*Agropyron violaceum* (Hornem.) Lange var. *latiglume* Scribn. & Sm. in U. S. Dept. Agric. Div. Agrost. Bull. **4:** 30 (1897).

Bank of Mackenzie R. at Simpson, *9119;* Mackenzie R. between Blackwater R. and Norman, *Crickmay 150* (Can.); local summit on hogback, north slope of Colonel Mt., alt. 4800′, *9610;* thickets at margin of timber on gravel fan, south shore of Brintnell L., *9690, 9696;* dry shale slope, south side of Red Mt., alt. 5000′, *9773;* dry gravel plain near west end of Brintnell L., *9801;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11189* (Can.).

Occasional to common; found in anthesis at Brintnell L. in late July and early August; the Simpson specimen was just coming into flower about mid-June.

Our specimens show great variation in the amount of pubescence on the lemmas (those in no. *9610* are nearly glabrous), and in the shape of the glumes. In the Simpson material the latter have broad scarious margins and are abruptly contracted at the apex, while those from Brintnell L. have narrower margins and more attenuate apices. Some of the Brintnell L. plants, notably those from the lower levels (nos. *9690, 9696, 9801*), suggest forms of *A. trachycaulum* in general aspect and in the form of the glumes. The writer is inclined to agree, however, with the late M. O. Malte (l. c.) in considering *A. latiglume* as a circumpolar arctic-alpine species complex in its own right, distinguished by its broad, flattish glumes which tend to be oblanceolate or obovate and conspicuously scarious-margined.

**Agropyron latiglume** (Scribn. & Sm.) Rydb. var. **pilosiglume** Hultén, Fl. Alaska & Yuk. Pt. 2: 259 (1942).

Sand bar along Mackenzie R. west of Simpson, *9888.*

Occasional in this habitat; spikelets maturing in late August. The strongly pubescent spikelets of this curious grass at once suggest *A. dasystachyon,* but it possesses none of the prominent creeping rhizomes of that species. In general habit it looks like typical *A. trachycaulum,* with its spikes somewhat elongated, scarcely imbricated, and the lower spikelets often distant. The closest relationship, however, is clearly with *A. latiglume*, indicated by the pubescent lemmas and the rather flat, oblong to obovate or oblanceolate, broadly scarious-margined empty glumes which are abruptly contracted toward the apex. It differs from *A. latiglume* in having pubescent glumes that are considerably shorter than the lemmas and much shorter than the spikelets, and in having an elongated, scarcely imbricated inflorescence. I have not seen any material cited by Hultén as var. *pilosiglume,* but venture to place the Simpson plants under this name at least tentatively.

**Arctophila fulva** (Trin.) Anders. Gram. Scand. 49 (1852); Hultén, Fl. Alaska & Yuk. Pt. 2: 224 (1942); Porsild in Nat. Mus. Can. Bull. **101:** 15 (1945).

*Poa fulva* Trin. in Mém. Acad. Sci. St. Pétersb. VI. Math. **1:** 378 (1831).

Macmillan Pass, Canol Rd., mi. 225 E., *Porsild* (Can.).

**Elymus canadensis** L. Sp. Pl. 83 (1753); Raup in Jour. Arn. Arb. **17:** 203 (1936).

Great Slave L., *Richardson* (G).

**Elymus innovatus** Beal, Grasses N. Amer. **2:** 650 (1896); Raup in Jour. Arn. Arb. **17:** 204 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 273 (1942); Porsild in Nat. Mus. Can. Bull. **101:** 16, 30 (1945).

*Elymus mollis* R. Br. in Richardson, Bot. App. Frankl. Journ. 732 (1823); Hooker, Fl. Bor.-Am. **2:** 255 (1840); Macoun, Cat. Can. Pl. Pt. 4: 246 (1888); non Trin.

Dry ridges at mouth of South Nahanni R., *Nowosad* (Can.); Mackenzie R., between Wrigley and Blackwater R., *Crickmay 125* (Can.); Lone Mt., *Wynne-Edwards 8427* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alt. 4420′, *Porsild 11828* (Can.); same place, *Wynne-Edwards 8243* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11845* (Can.).

Noted in Fl. Bor.-Am. from "Saskatchewan to Bear Lake. . . ." Common in the Wood Buffalo Park, and collected on the lower Mackenzie and at Great Bear L. by Porsild (Sargentia **4:** 13, 1943). Porsild states that it is very common along the Canol Rd.

**Elymus arenarius** L. var. **villosus** E. Mey. Pl. Labrad. 20 (1830). See St. John in Rhod. **17:** 98–103 (1915).

*Elymus arenarius* L.; Hooker, Fl. Bor.-Am. **2:** 255 (1840), in part.

*Elymus arenarius* L. ssp. *mollis* (Trin.) Hultén in Vet. Akad. Handl. III. **5:** 153 (1927), Fl. Alaska & Yuk. Pt. 2: 268 (1942).

Southwest and north shores of Great Slave L., *Howe 91989* (Can.); northwest shore of Great Slave L., *Bedford* (Can.).

Common on the shores of larger lakes in the central part of the Mackenzie basin, and noted in Fl. Bor.-Am. from "Saskatchewan to Bear Lake and the extreme Arctic shores and islands." There is a Richardson specimen from Bear L. at Herb. G, but none from the upper Mackenzie have yet been seen.

**Hordeum jubatum** L. Sp. Pl. 85 (1753); Hooker, Fl. Bor.-Am. **2:** 256 (1840); Macoun, Cat. Can. Pl. Pt. 4: 243 (1888); Raup in Jour. Arn. Arb. **17:** 204 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 266 (1942).

Resolution, *Harper 90056* (Can.); shore of Mackenzie R., 10 mi. below Mills L., *Wynne-Edwards 8544* (Can.); dry terrace in open field at Simpson, *9853;* Saline R., above Norman, *Wynne-Edwards 8570* (Can.).

Our specimens are badly infected with a fungus which has greatly reduced and distorted the inflorescences. Noted in Fl. Bor.-Am. from the "Saskatchewan to the Mackenzie River."

**Trisetum spicatum** (L.) Richter, Pl. Eur. **1:** 59 (1890); Hultén, Fl. Alaska & Yuk. Pt. 2: 184 (1942); Porsild in Nat. Mus. Can. Bull. **101:** 15 (1945).

*Aira spicata* L. Sp. Pl. 64 (1753).

*Trisetum subspicatum* (L.) Beauv.; Hooker, Fl. Bor.-Am. **2:** 244 (1840), in part.

Liard R., Nahanni Butte to Simpson, *Crickmay 6* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8234* (Can.); noted by Porsild as common in Macmillan Pass, Canol Rd., mi. 225 E.

**Trisetum spicatum** (L.) Richter var. **molle** (Michx.) Beal, Grasses N. Amer. **2:** 377 (1896); Raup in Jour. Arn. Arb. **17:** 204 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 30 (1945). See Rhod. **18:** 195–198 (1916).

*Avena mollis* Michx. Fl. Bor.-Am. **1:** 72 (1803).

*Trisetum subspicatum* (L.) Beauv. var. *molle* Gray; Macoun, Cat. Can. Pl. Pt. 4: 212 (1888).

North peak of Nahanni Mt., *Wynne-Edwards 8426* (Can.).

Variety *molle* is the common form of the species in the central part of the Mackenzie basin. Judging by specimens I have seen from Great Bear L. (*Richardson,* G, N; *J. M. Bell,* Can.) it is common in that region also. The record in Fl. Bor.-Am., "Rocky Mountains . . . to the Arctic Sea-shore and Islands," probably refers in large part to this variety.

**Trisetum spicatum** (L.) Richter var. **Maidenii** (Gand.) Fernald in Rhod. **18:** 196 (1916).

*Trisetum subspicatum* (L.) Beauv. f. *Maidenii* Gand. in Bull. Soc. Bot. France **49:** 182 (1902).

Stony shore of Brintnell L., *9172;* shale cliffs on north slope of Colonel Mt., alt. 4800′–6000′, *9392, 9612;* dry ridges on north slope of Terrace Mt., alt. 4000′–5000′, *9675, 9683;* turfy ledges on summit of Red Mt., alt. 5900′, *9770;* dry shale slope on south side of Red Mt., alt. 5000′, *9774.*

Occasional to common, chiefly on ledges above timber line, but reappearing on the lake shore; in anthesis in the latter part of June, and mature in August. Our plants are extremely variable in the color and form of the inflorescence, but most of them fall into var. *Maidenii* which has bronze to purplish spikelets and the inflorescence somewhat elongated and interrupted toward the base. The greenish to straw-colored var. *molle* is not represented, although, as previously noted, it is quite common in the central part of the Mackenzie basin. Three of the numbers cited (*9172, 9392, 9683*) approach the typical variety in having dense ovate inflorescences on some of the culms. Other culms in the same colony may have them more elongate and interrupted.

**Deschampsia cespitosa** (L.) Beauv. Ess. Agrost. 91, 149, 160, *pl. 18, f. 3* (1812); Hooker, Fl. Bor.-Am. **2:** 242 (1840), in part; Macoun, Cat. Can. Pl. Pt. 4: 209 (1888), in part; Hultén, Fl. Alaska & Yuk. Pt. 2: 175 (1942).

*Aira cespitosa* L. Sp. Pl. 64 (1753).

Sand bar at mouth of small creek entering Mackenzie R. opposite Simpson, *9957;* rocky-sandy bank of Mackenzie R. opposite Simpson, *9962;* dry ridges at mouth of South Nahanni R., *Nowosad* (Can.).

Common in this habitat; spikelets mature the last week in August. Noted in Fl. Bor.-Am. from "Saskatchewan to Bear Lake." Our plants are relatively tall and robust, apparently representing the species rather than var. *glauca* (see Fernald in Rhod. **28:** 154). The panicles are often 2.5–3 dm. long. Number

*9957* is worthy of special note since it is strongly viviparous. This is carried to such an extreme in some individuals that the whorls of the inflorescence are composed of dense fascicles of proliferating spikelets which are strongly tinged with purple. The occurrence of vivipary in North American *D. cespitosa* seems to be rather unusual. The species is common throughout those parts of the Mackenzie basin visited by the writer, but no viviparous forms have been observed previously. Hitchcock (Man. Grasses of U. S., p. 290) states that the species is "rarely with proliferous spikelets," and in the large series of American specimens at the Gray Herbarium only one such form could be found (*Fernald & Long 19947,* Digby Co., Nova Scotia, as *D. cespitosa* var. *glauca*). According to Ostenfeld (Fl. Arctica, 113) the proliferous form of the species is *D. alpina* (L.) R. & S. Hultén failed to find this in the Aleutians (Fl. Aleut. Isls., 80–82), or in Alaska (Fl. Alaska & Yuk., 173–180). Porsild (Rhod. **41**: 179) does not mention it among his collections from Alaska. Simmons makes no note of vivipary in *Deschampsia* (*Aira*) *cespitosa* either in his flora of Ellesmereland or of the American Arctic Archipelago. Abbe, however, collected plants along the northern Labrador coast which have been determined as *D. alpina* (L.) R. & S. (Rhod. **38**: 140). Polunin (Fl. E. Arct. Can. 55–60) places all eastern Arctic viviparous forms of the *cespitosa* group in *D. alpina,* and records it only from southern Baffin and northern Labrador. He regards it as identical with plants from south Greenland and almost identical with those of northern Europe and Spitzbergen. Gelting states (Meddel. om Grønland, Bd. 101, Nr. 2: 188) that in East Greenland vivipary does not occur in the group. On the other hand viviparous forms are rather common in northern Europe. None of the eastern American or European *D. alpina* is tall and robust like our Simpson specimens, nor does it show the tendency to dense fasciation in the inflorescence.

**Deschampsia brevifolia** R. Br. Suppl. App. Parry's 1st Voy. 291 (mispaged 191) (1824); Porsild in Nat. Mus. Can. Bull. **101**: 15 (1945). See Fernald in Rhod. **36**: 90 (1934).

Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11197* (Can.).

**Vahlodea atropurpurea** (Wahl.) Fries ssp. **paramushirensis** (Kudo) Hultén, F. Kamtch. **1**: 111 (1927); Hultén, Fl. Alaska & Yuk. Pt. 2: 180 (1942); Porsild in Nat. Mus. Can. Bull. **101**: 15 (1945).

*Deschampsia atropurpurea* var. *paramushirensis* Kudo in Jour. Coll. Agric. Hokkaido Univ. Sapporo **11**: 71 (1922).

Macmillan Pass, Canol Rd., mi. 225 E., just east of the Yukon-Mackenzie divide, *Porsild 11194* (Can.).

**Calamagrostis purpurascens** R. Br. apud Richardson, Bot. App. Franklin's Journ. 731 (1823); Hooker, Fl. Bor.-Am. **2**: 240 (1839); Raup in Jour. Arn. Arb. **17**: 206 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 170 (1942); Porsild in Nat. Mus. Can. Bull. **101**: 15, 30 (1945). See Fernald in Rhod. **35**: 213 (1933).

Gravelly thickets on shore of Brintnell L. near camp, *9308;* alpine rock crevices on north slope of Colonel Mt., *9420;* shale cliffs in gorge near east end of Brintnell L., *9588;* hogback on north slope of Colonel Mt., alt. 4800′, *9611;* wooded south-facing slope of Red Mt., alt. 3500′–4000′, *9667, 9673, 9777;* Lone Mt., *Wynne-Edwards 8425* (Can.); Sekwi R., Canol Rd., mi. 174 E., alt. 3625′, *Porsild 11844* (Can.).

Common; in anthesis in late June or early July. This is one of the commonest grasses on rocky alpine slopes, though it is nowhere a primary species in the plant associations. On dry, warm slopes and crevices at lower elevations it grows tall (8–10 dm.), with paler purple in the spikelets than the typical form.

Noted in Fl. Bor.-Am. as occurring on the "Rocky Mountains and Arctic seashore." Frequent throughout most of the Athabaska–Great Slave L. region (Raup, 1935, 1936).

**Calamagrostis lapponica** (Wahl.) Hartm. Handb. Skand. Fl. ed. 1: 46 (1820); Hultén, Fl. Alaska & Yuk. Pt. 2: 166 (1942).

*Arundo lapponica* Wahl. Fl. Lapp. 27 (1812).

Turfy ledge on summit of Red Mt., Brintnell L. region, alt. 5900′, *9790*.

Common in this situation but not seen elsewhere. Found in early anthesis on Aug. 7.

The existence of typical *Calamagrostis lapponica* on the American continent has long been questioned. Scribner & Merrill (Contr. U. S. Nat. Herb. **13**: 61, 1910) considered specimens seen by them from Dall R., Alaska (*O. A. Piper*) to represent the typical form. Hultén (Fl. Alaska & Yuk. Pt. 2: 166–167, 1942) apparently supports this view, and cites several other Yukon and Alaska collections which he also regards as typical. Stebbins (Rhod. **32**: 56, 1930) did not recognize any typical material in America, but described a var. *brevipilis* from the Straits of Belle Isle, in Quebec. Britton & Rydberg (Bull. N. Y. Bot. Gard. **2**: 154, 1901) considered specimens they had from the upper Yukon to be typical. Porsild (Sargentia **4**: 10–12, 1943) has described a var. *nearctica* from the Mackenzie delta region which he distinguishes from the typical species by its smaller stature and by its shorter and narrower panicles and glumes. He regards this as probably the principal representative of *C. lapponica* in America, with a distribution from western Alaska to the northwest coast of Hudson Bay, and southward into the Canadian Rockies. He considers that many American specimens determined as *C. lapponica* are referable to *C. neglecta* or *C. hyperborea*.

It is impossible for me to judge the relative merits of these views regarding all the northwestern material, but our material from the Brintnell Lake area matches very well the rather large series of Eurasian specimens in the Gray Herbarium. The awn is attached somewhat higher on the lemma (⅓ to ½ way up from the base) than in some of these specimens, but the character is sufficiently variable to make it of little diagnostic value. Stebbins' var. *brevipilis* (considered by Porsild a form of *C. neglecta*) is distinguished by its short callus hairs (⅔ the length of the lemma); but in our plants the callus hairs are fully as long as the lemma, closely resembling those of the typical form. Var. *brevipilis* is also noted as having "innovations numerous," but here also our specimens match the Eurasian.

Porsild's var. *nearctica* is described as having lax panicles which are narrow to somewhat open. Our specimens have rather dense, upright panicles, the whole aspect of the plants resembling that of *C. purpurascens*. Otherwise they match Porsild's description rather well. They have anthers 2 mm. long, lemmas 3.5–4 mm., paleas ¾ the length of the lemmas, glumes 4–5 mm., awns about as long as the lemmas, not twisted and scarcely bent.

As Stebbins has pointed out (l. c.), *C. lapponica* seems to combine some of the principal characters which are commonly used to define the Sections *Calamagris* and *Deyeuxia*. It has the long callus hairs of the former and the thick lemma of the latter. Its short palea (⅓–¾ as long as the lemma) places it in the subsection *Orthoatherae* of *Deyeuxia*, while its bent and slightly geniculate awn suggests the subsection *Ancylatherae*.

**Calamagrostis canadensis** (Michx.) Nutt. Gen. **1:** 46 (1818); Hooker, Fl. Bor.-Am. **2:** 240 (1839), in part; Raup in Jour. Arn. Arb. **17:** 206 (1936). See Stebbins in Rhod. **32:** 42 (1930).

*Arundo canadensis* Michx. Fl. Bor.-Am. **1:** 73 (1803).

*Deyeuxia canadensis* (Michx.) Hooker; Macoun, Cat. Can. Pl. Pt. 4: 204 (1888).

Along lower Slave R., near Pt. Brulé, *Raup 231, 232;* mouth of Rocher R., Great Slave L., *Harper 90055* (Can.).

The typical form, with very short spikelets, is common in the Athabaska and Slave R. lowlands, but appears to reach its northern limits at Great Slave L. or on the upper Mackenzie.

**Calamagrostis canadensis** (Michx.) Nutt. var. **robusta** Vasey in Wheeler, Rept. U. S. Surv. 100th Merid. **6:** 285 (1878); Raup in Jour. Arn. Arb. **17:** 207 (1936). See Stebbins in Rhod. **32:** 42 (1930).

*Calamagrostis canadensis* (Michx.) Nutt. ssp. *Langsdorfi* (Link) Hultén, Fl. Alaska & Yuk. Pt. 2: 161 (1942), in part.

Northwest shore of Great Slave L., *Bedford* (Can.); east shore of Trout L., *C. O. Hage* (G); grassy swale near Ft. Liard, *Nowosad* (Can.); gravelly thickets along shore of Brintnell L. at Camp Pt., *9466;* mossy thickets on north shore of Brintnell L. near camp, *9600.*

Common in the open association of herbs that borders the willow and alder thickets at the shore of Brintnell L.; in anthesis about mid-July. Probably common throughout southwestern Mackenzie, though the only specimen I have seen that may have come from the upper Mackenzie valley is without locality data (*Onion, Kennicott & Hardisty,* N). Collected at Good Hope by *Miss E. Taylor* (Can.). This is the commonest form of the species in the Athabaska–Great Slave L. region. Hultén, in Fl. Alaska & Yuk., reduces var. *robusta* to his ssp. *Langsdorfi,* which hardly seems justifiable in view of the geographic position of the former in the interior of the continent.

**Calamagrostis canadensis** (Michx.) Nutt. var. **Langsdorfi** (Link) Inman in Rhod. **24:** 143 (1922); Porsild in Nat. Mus. Can. Bull. **101:** 15 (1945). See Stebbins in Rhod. **32:** 43 (1930).

*Arundo Langsdorfi* Link, Enum. Pl. Hort. Berol. **1:** 74 (1821).

*Calamagrostis canadensis* (Michx.) Nutt. ssp. *Langsdorfi* (Link) Hultén, Fl. Alaska & Yuk. Pt. 2: 161 (1942), in part.

Mackenzie R., between Blackwater R. and Norman, *Crickmay 151* (Can.); damp mud flat near mouth of creek at west end of Brintnell L., *9688;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11201* (Can.).

Common to abundant at the west end of Brintnell L. on the higher parts of the newly formed mud-flats, near the first willows; a primary species, associated in some places with *Arctagrostis arundinacea;* in anthesis early in August. Hitchcock, in Am. Jour. Bot. **21:** 135 (1934), identified most if not all American plants long regarded as var. *Langsdorfi* with var. *scabra* (Presl) Hitchc., and did not admit var. *Langsdorfi* to the American flora. I am inclined to agree with Hultén (l. c.), however, that this large-flowered form of *C. canadensis* is circumpolar.

**Calamagrostis inexpansa** Gray var. **brevior** (Vasey) Stebbins in Rhod. **32:** 50 (1930); Raup in Jour. Arn. Arb. **17:** 207 (1936).

*Calamagrostis stricta* var. *brevior* Vasey in Wheeler Rep. **6:** 285 (1878).

*Calamagrostis inexpansa* Gray; Porsild in Nat. Mus. Can. Bull. **101:** 33, 34 (1945); Hultén, Fl. Alaska & Yuk. Pt. 2: 164 (1942), in part.

Rocky-sandy bank of Mackenzie R., opposite Simpson, *9961;* outwash gravel plain along the Mackenzie near the mouth of the N. Nahanni R., *Wynne-Edwards 8535* (Can.); Saline

R., above Norman, *Wynne-Edwards 8568* (Can.); "Cumberland House to Bear L.," *Richardson* (G).

Common at the Simpson locality; with maturing spikelets in late August.

**Calamagrostis neglecta** (Ehrh.) Gaertn., Meyer & Scherb. Fl. Wetterau 94 (1799); Hultén, Fl. Alaska & Yuk. Pt. 2: 167 (1942). See Stebbins in Rhod. **32**: 53 (1930).

*Arundo neglecta* Ehrh. Beitr. **6**: 84, 137 (1791).

*Calamagrostis coarctata* (Torr.) Hooker, Fl. Bor.-Am. **2**: 240 (1839), at least in part.

Upland prairie west of Mackenzie R. near Simpson, *9905;* wet meadow at west end of Brintnell L., *9715.*

Abundant at the Brintnell L. station, where it is a primary species along the lake shore near muskeg thickets; in anthesis the first week in August. In the prairie near Simpson it is a primary species in the drier parts, and was maturing its spikelets late in August. The record for *C. coarctata,* "woody country," in Fl. Bor.-Am. probably refers to this species.

**Agrostis scabra** Willd. Sp. Pl. **1**: 370 (1798); Raup in Jour. Arn. Arb. **17**: 208 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 155 (1942). See Fernald in Rhod. **35**: 207–212 (1933).

Wet gravelly shore of Brintnell L. at Camp Pt., *9468;* along dry rocky gullies and on fans on southward-facing slope of granite mountain W. of Brintnell L., *9484;* dry shale slopes on south side of Terrace Mt., alt. 3500′–5000′, *9679;* damp mud holes and mossy muskeg thickets at W. end of Brintnell L., *9714;* "Cumberland House to Bear Lake," *Richardson* (G).

Occasional to common in the Brintnell L. habitats noted, but not found on cold north-facing slopes. In anthesis about mid-July. Two of the numbers (those from lake-level, *9468* and *9714*) have some of the lemmas awned and probably represent f. *Tuckermani* Fern. The awns are attached above the middle of the lemmas and scarcely extend beyond the tips of the glumes.

**Cinna latifolia** (Trev.) Griseb. in Ledeb. Fl. Ross. **4**: 435 (1853); Hultén, Fl. Alaska & Yuk. Pt. 2: 148 (1942).

*Agrostis latifolia* Trev. in Goepp. Beschr. Bot. Gard. Breslau, 82 (1832).

Sand bars along Mackenzie R., just west of Simpson, *9887.*

Occasional; found with maturing spikelets in the last week of August. *Cinna latifolia* has not been reported previously in the Mackenzie basin north of Lake Athabaska (Raup, 1936, p. 208). In its more southern range it is a characteristic species of rich woods and thickets, but at Simpson it was seen only on river sand bars.

**Arctagrostis latifolia** (R. Br.) Griseb. in Ledeb. Fl. Ross. **4**: 434 (1853); Porsild in Nat. Mus. Can. Bull. **101**: 15 (1945).

*Colpodium latifolium* R. Br. Verm. Schr. **1**: 414 (1825).

Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8235* (Can.).

Noted by Porsild as common also in wet places on the alpine "Plains of Abraham," along the Canol Rd. near mi. 81 E.

**Arctagrostis arundinacea** (Trin.) Beal, Grasses N. Amer. **2**: 317 (1896); Raup in Jour. Arn. Arb. **17**: 208 (1936); Porsild in Nat. Mus. Can. Bull. **101**: 15 (1945).

*Vilfa arundinacea* Trin. De gram. unifl. et sesquifl. 127 (1829).

*Colpodium arundinaceum* (Trin.) Hooker, Fl. Bor.-Am. **2**: 238 (1839).

*Arctagrostis latifolia* (R. Br.) Griseb. var. *arundinacea* (Trin.) Griseb. in Ledeb. Fl. Ross. **4**: 435 (1853); Hultén, Fl. Aleut. Isls. 71 (1937), Fl. Alaska & Yuk. Pt. 2: 145 (1942).

Along wood road on bluff above Mackenzie R. west of Simpson, *9907;* gravelly willow-alder thickets on shore of Brintnell L., *9464;* mossy shore of an old stream channel near west end of Brintnell L., *9496;* along small brook on west slope of Terrace Mt., alt. 4800′, *9533;* muskeg thicket on north shore of Brintnell L., *9567, 9568;* damp stony beach at mouth of Frost Creek, *9672;* wet meadow on mud flat near west end of Brintnell L., *9698, 9701;* gravelly lake shore at Camp Pt., *9800;* open wood of black spruce on north slope of Colonel Mt., alt. about 3500′, *9819;* "Cumberland House to Bear Lake," *Richardson* (G).

Common to abundant on the shores of Brintnell L., and a primary species on some parts of the recently formed alluvial deposits at the western end; at higher elevations it is only occasional. In anthesis about mid-July. Noted by Porsild as common in Macmillan Pass along the Canol Rd.

Some students have considered the genus *Arctagrostis* to be monotypic (Grisebach in Ledebour's Flora Rossica; Hultén in Fl. Aleut. Isls.; Holm in Bot. Can. Arct. Exp. Pt. B. p. 4), with *A. latifolia* as the typical species. Others, such as Scribner & Merrill in Grasses of Alaska, 55, and Porsild in Rhod. **41:** 178, have maintained *A. arundinacea* as a distinct species. More recently Hultén, in Fl. Alaska & Yuk. Pt. 2: 148, recognized a second species, *A. poaeoides* Nash, in Alaska, but still maintained *A. arundinacea* as a variety of *A. latifolia.* There are at the Gray Herbarium numerous well prepared specimens of *A. latifolia* from most parts of the American Arctic. They are all relatively short plants with dense inflorescences in which there is very little tendency to the elongation of branches or main axis. The spikelets are usually 4–5 mm. long and the anthers 2–2.7 mm. long (usually 2.1–2.5 mm.). *Arctagrostis arundinacea* in the Brintnell L. region, on the other hand, commonly grows to a height of 1.2 m., with inflorescences freely branched and as much as 3 dm. long. Some of the lower branches are naked for more than half their length. The spikelets are shorter than those of *A. latifolia* (3.5–4 mm.), and the anthers vary from 1.2 to 2.1 mm. long (usually 1.4–1.8 mm.). Another character is that of the "collar" which subtends the lowest whorl of the inflorescence. In *A. arundinacea* it is much more obliquely cut than in *A. latifolia.* With these differences in mind it seems best to maintain the two as separate species.

As it first comes into flower the inflorescence of *A. arundinacea* has a "moniliform" appearance due to the elongation of the main axis without accompanying development of the branches. The latter soon grow out, however, and while the plant is in anthesis the whole inflorescence is expanded so that the rather stiff branches come off almost at right angles. After anthesis the branches are contracted toward the main axis, the whole inflorescence becoming strict and remaining so until maturity.

**Alopecurus alpinus** Sm. Fl. Brit. **3:** 1386 (1804); Hultén, Fl. Alaska & Yuk. Pt. 2: 140 (1942); Porsild in Nat. Mus. Can. Bull. **101:** 15 (1945). See Rhod. **27:** 196 (1925).

Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11191* (Can.).

Noted by Porsild as rare or occasional in Macmillan Pass.

**Alopecurus aequalis** Sobol. Fl. Petrop. 16 (1799); Raup in Jour. Arn. Arb. **17:** 208 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 139 (1942).

*Alopecurus aristulatus* Michx.; Hooker, Fl. Bor.-Am. **2:** 233 (1839).

*Alopecurus geniculatus* L. var. *aristulatus* Munro; Macoun, Cat. Can. Pl. Pt. 4: 188 (1888).

Damp slough in lowland woods near Simpson, *9841;* grassy swale near Ft. Liard, *Nowosad* (Can.).

Common; in fruit late in August. Noted in Fl. Bor.-Am. from "Canada to Bear Lake."

**Phleum alpinum** L. Sp. Pl. 59 (1753); Porsild in Nat. Mus. Can. Bull. **101**: 14 (1945)

*Phleum alpinum* L. var. *americanum* Fourn., sensu Hultén, Fl. Alaska & Yuk. Pt. 2: 136 (1942).

Noted by Porsild at Macmillan Pass along the Canol Rd., mi. 225 E., alt. about 5000′.

Hultén, l. c., considers the northwestern American plants distinct from those of northern Scandinavia, but admits that they cannot always be told apart.

**Muhlenbergia Richardsonis** (Trin.) Rydb. in Bull. Torr. Bot. Cl. **32**: 600 (1905).

*Vilfa Richardsonis* Trin. in Mém. Acad. St. Pétersb. VI. Sci. Nat. **4**[1]: 103 (1840).

This species is abundant on the Salt Plains west of the upper Slave R. (Raup, Jour. Arn. Arb. **17**: 209, 1936), and has been collected by Porsild along Bear R. (Sargentia **4**: 9, 1943). It has not yet been seen, however, along the upper Mackenzie.

**Beckmannia Syzigachne** (Steud.) Fernald in Rhod. **30**: 27 (1928); Raup in Jour. Arn. Arb. **17**: 209 (1936); Porsild in Sargentia **4**: 9 (1943); Hultén, Fl. Alaska & Yuk. Pt. 2: 188 (1942).

*Beckmannia erucaeformis* sensu Richardson, Bot. App. Franklin's Journ. 731 (1823), non R. & S.

Damp lowland sloughs and sand bars along the Mackenzie R. near Simpson, *9873;* Simpson, *Miss E. Taylor 90* (N, Can.); grassy swale near Ft. Liard, *Nowosad* (Can.).

Common on river flood plains northward to the Mackenzie delta; spikelets mature at Simpson during the last week in August.

**Spartina gracilis** Trin. in Mém. Acad. St. Pétersb. VI. Sci. Nat. **4**[1]: 110 (1840); Raup in Jour. Arn. Arb. **17**: 209 (1936).

Junction of the Little Buffalo and Nyarling Rivers, *Russell 62* (G).

The range of *Spartina polystachya,* which may have included both *S. gracilis* and *S. pectinata,* is given in Fl. Bor.-Am. **2**: 242 (1840) as "Saskatchewan to Slave Lake," but there is a specimen of *S. gracilis* in Herb. G marked "Cumberland House to Bear Lake." This specimen was originally marked *S. polystachya.*

**Spartina pectinata** Link in Jahrb. Gewächsk **1**[3]: 92 (1820); Raup in Jour. Arn. Arb. **17**: 210 (1936).

*Spartina polystachya* sensu Hooker, Fl. Bor.-Am. **2**: 242 (1840), in part, non Willd.

Resolution, *Onion, Kennicott & Hardisty* (N).

See note under *S. gracilis.*

**Hierochloë alpina** (Sw.) R. & S. Syst. Veg. **2**: 514 (1817); Hultén, Fl. Alaska & Yuk. Pt. 2: 132 (1942); Porsild in Nat. Mus. Can. Bull. **101**: 14 (1945).

*Holcus alpinus* Sw. in Willd. Sp. Pl. **4**, 2: 937 (1805).

Alpine meadows on south slope of Red Mt., alt. 4600′, *9232;* along small brook on east slope of Red Mt., alt. 4500′, *9267;* shale rock slide on west slope of Terrace Mt., alt. 5500′, *9536;* summit and higher eastern slopes of Red Mt., alt. 5800′–5900′, *9791;* Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8233* (Can.).

Common to abundant in high alpine meadows on the north side of Brintnell L., but not seen on the N. slope of Colonel Mt.; in anthesis the last week of June.

**Hierochloë odorata** (L.) Wahl. Fl. Upsal. 32 (1820); Raup in Jour. Arn. Arb. **17**: 210 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 133 (1942).

*Holcus odoratus* L. Sp. Pl. 1048 (1753).

Resolution, *Kennicott* (N); old fields, clearings and roadsides at Simpson, *9135;* in meadows, Bell R., Mackenzie R., *McConnell 29487* (Can.).

Abundant at Simpson; in anthesis about mid-June.

**Phalaris arundinacea** L. Sp. Pl. 55 (1753); Hooker, Fl. Bor.-Am. **2:** 234 (1839); Macoun, Cat. Can. Pl. Pt. 4: 185 (1888); Hultén, Fl. Alaska & Yuk. Pt. *2*: 131 (1942).

Damp places in upland prairie west of the Mackenzie R. near Simpson, *9908;* grassy swale near Ft. Liard, *Nowosad* (Can.).

Common in this habitat; spikelets maturing in the last week of August. Noted in Fl. Bor.-Am. from ". . . Canada . . . to the Bear Lake."

## CYPERACEAE

**Eriophorum Scheuchzeri** Hoppe, Bot. Taschenb. 104, app. *tab. 7* (1800); Raup in Jour. Arn. Arb. **17:** 210 (1937); Hultén, Fl. Alaska & Yuk. Pt. *2*: 284 (1942); Porsild in Nat. Mus. Can. Bull. **101:** 16 (1945).

*Eriophorum capitatum* sensu Hooker, Fl. Bor.-Am. **2:** 231 (1839), in part; Macoun, Cat. Can. Pl. Pt. 4: 104 (1888), in part; not Host.

Simpson, *coll. ?,* May 19, 1860 (N); mud flat at west end of Brintnell L., *9265*

Abundant at Brintnell L.; in flower the last week of June. A primary species on the most recently formed deposits of glacial mud, where it is associated with *Juncus castaneus.* At least a part of the material cited in Fl. Bor.-Am. under *E. capitatum,* "From Quebec . . . to the Arctic coasts and islands," belongs here. Noted by Porsild at Macmillan Pass, on the Canol Road.

**Eriophorum vaginatum** L. Sp. Pl. 52 (1753); Raup in Jour. Arn. Arb. **17:** 211 (1936); Hultén, Fl. Alaska & Yuk. Pt. *2*: 286 (1942); Porsild in Sargentia **4:** 14 (1943); Porsild in Nat. Mus. Can. Bull. **101:** 16 (1945).

Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8245* (Can.).

**Eriophorum Chamissonis** C. A. Mey. forma **albidum** (F. Nyl.) Fernald in Rhod. **23:** 131 (1921); Raup in Jour. Arn. Arb. **17:** 210 (1936).

*Eriophorum russeolum* Fries var. *albidum* F. Nyl. in Acta Soc. Sc. Fenn. **3:** (1852) and in Anders. Bot. Notiser **1857:** 58 (1857).

*Eriophorum russeolum* Fries var. *leucothrix* (Blomgr.) Hultén, Fl. Alaska & Yuk. Pt. *2*: 283 (1942).

Resolution, *Kennicott* (N).

Occasional in the Athabaska–Great Slave L. region, and probably also throughout the Mackenzie country.

**Eriophorum brachyantherum** Trautv. Fl. Ochot. Phaenog. in Middend., Reise i. d. Äussersten N. v. O. Sibieriens **1,** *2*: 58 (1856); Hultén, Fl. Alaska & Yuk. Pt. *2*: 279 (1942).

*Eriophorum opacum* (Björnstr.) Fernald; Raup in Jour. Arn. Arb. **17:** 210 (1936); Porsild in Sargentia **4:** 14 (1943); Porsild in Nat. Mus. Can. Bull. **101:** 16 (1945).

Liard R., Nahanni Butte to Simpson, *Crickmay 8* (Can.); muskeg thickets and mossy banks around the western end of Brintnell L., *9245.*

Abundant in the Brintnell L. area; in fruit late in June. Noted by Porsild on a small tributary of the Little Keele R., along the Canol Rd.

**Eriophorum spissum** Fernald in Rhod. **27:** 208 (1925); Raup in Jour. Arn. Arb. **17:** 211 (1936); Porsild in Sargentia **4:** 14 (1943).

*Eriophorum vaginatum* L. ssp. *spissum* (Fernald) Hultén, Fl. Alaska & Yuk. Pt. *2*: 286 (1942).

This species has not yet been collected in the upper Mackenzie valley, though it is to be expected there. It is common in the Wood Buffalo Park, and has been collected on the lower Mackenzie (*Stringer,* Can.).

**Eriophorum angustifolium** Roth, Tent. **1:** 24 (1788); Hooker, Fl. Bor.-Am. **2:** 231 (1839); Raup in Jour. Arn. Arb. **17:** 211 (1936); Hultén, Fl. Alaska & Yuk. Pt. *2*: 276 (1942); Porsild in Nat. Mus. Can. Bull. **101:** 16 (1945).

Liard R., Nahanni Butte to Simpson, *Crickmay 7* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8244* (Can.); Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11217* (Can.).

Noted in Fl. Bor.-Am. as occurring from "Canada to Arctic America." Porsild reports it along the Canol Road, and also at Little Keele R. and on the "Plains of Abraham."

**Eriophorum gracile** Koch in Roth, Catalect. 2: add. 259 (1800); Hooker, Fl. Bor.-Am. 2: 232 (1839); Macoun, Cat. Can. Pl. Pt. 4: 106 (1888); Hultén, Fl. Alaska & Yuk. Pt. 2: 280 (1942).

Noted in Fl. Bor.-Am. as occurring from "Saskatchewan to Arctic America." Otherwise we have no Mackenzie basin records for the species except at Lesser Slave Lake (*Brinkman 4542,* N).

**Scirpus caespitosus** L. var. **callosus** Bigel. Fl. Bost. ed. 2, 21 (1824). See Rhod. **23:** 22 (1921).

*Eleocharis caespitosa* (L.) Link; Hooker, Fl. Bor.-Am. **2:** 229 (1839), in part.

Noted in Fl. Bor.-Am. as occurring "Throughout Canada to near the shores of the Arctic Sea. . . ," but I have seen no material from north of Great Slave L.

**Scirpus validus** Vahl. Enumer. Pl. **2:** 268 (1806); Raup in Jour. Arn. Arb. **17:** 212 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 295 (1942); Porsild in Sargentia **4:** 14 (1943).

North of the height of land between Great Slave and Great Bear Lakes, *Bedford* (Can.); Mackenzie R. near Norman, *Porsild 5367* (Can.).

**Scirpus microcarpus** Presl, Rel. Haenk. **1:** 195 (1828); Raup in Jour. Arn. Arb. **17:** 212 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 292 (1942).

Resolution, *Kennicott* (N).

**Eleocharis pauciflora** (Lightf.) Link, Hort. Berol. **1:** 284 (1827); Porsild in Sargentia **4:** 14 (1943).

*Scirpus pauciflorus* Lightf. Fl. Scot. **2:** 1078 (1777); Hultén, Fl. Alaska & Yuk. Pt. 2: 294 (1942).

Known in the Athabaska–Great Slave L. district (*Raup 6833, 374*), and at Great Bear L. (*Porsild* l. c.), but not yet collected along the upper Mackenzie.

**Eleocharis palustris** (L.) R. & S. Syst. **2:** 151 (1817); Hooker, Fl. Bor.-Am. **2:** 228 (1839); Raup in Jour. Arn. Arb. **17:** 212 (1936); Porsild in Sargentia **4:** 14 (1943).

*Scirpus palustris* L. Sp. Pl. 47 (1753); Hultén, Fl. Alaska & Yuk. Pt. 2: 294 (1942).

Sand bars along Mackenzie R. near Simpson, *9903;* sandy bank of Mackenzie R. opposite Simpson, *9966;* grassy swale near Ft. Liard, *Nòwosad* (Can.).

Occasional to common locally; in fruit the last week in August. Noted in Fl. Bor.-Am., "Throughout Canada to Bear Lake," and collected by Porsild at Bear Lake (*4668,* Can.) and along the Bear R. (*3376,* Can.).

The Simpson specimens are of low stature (1.5–2.5 dm.) and grow from rather stout, long, horizontal rootstocks. The bristles on the achenes are a little longer than usual, but otherwise the specimens can be placed in var. *typica* Rouy.

**Eleocharis acicularis** (L.) R. & S. Syst. 2: 154 (1817); Porsild in Sargentia **4:** 14 (1943).

*Scirpus acicularis* L. Sp. Pl. 48 (1753); Hultén, Fl. Alaska & Yuk. Pt. 2: 289 (1942).

Bank of Mackenzie R. opposite Simpson, *Crickmay 40* (Can.).

Common in the Wood Buffalo Park (Raup in Jour. Arn. Arb. **17:** 213) and collected frequently by Porsild (l. c.) at Great Bear L. and on the lower Mackenzie.

**Kobresia simpliciuscula** (Wahl.) Mackenzie in Bull. Torr. Bot. Cl. **50**: 349 (1923); Hultén, Fl. Alaska & Yuk. Pt. 2: 297 (1942); Porsild in Nat. Mus. Can. Bull. **101**: 16 (1945).

*Carex simpliciuscula* Wahl. in Sv. Vet. Akad. Handl. (Stockh.) **24**: 141 (1801).

Plains of Abraham, Canol Rd., mi. 82 E., on bald, wind-swept summit, alt. 6000′, *Porsild 11788* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8246* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11846* (Can.).

Porsild states that this species is common along the Canol Road.

**Carex nardina** Fries var. **Hepburnii** (Boott) Kükenth. in Pflanzenr. **38** (IV. 20): 70 (1909); Hultén, Fl. Alaska & Yuk. Pt. 2: 299 (1942), at least in part; Porsild in Sargentia **4**: 15 (1943), in Nat. Mus. Can. Bull. **101**: 16 (1945).

*Carex Hepburnii* Boott in Hooker, Fl. Bor.-Am. **2**: 209, *tab. 207* (1839); Mackenzie in N. Am. Fl. **18**: 22 (1931), *tab. 2* (1940).

Rock slides, crevices and turf on north slope of Colonel Mt., alt. 5000′–5500′, *9394, 9604, 9605;* Plains of Abraham, Canol Rd., mi. 82 E., alt. 6000′, *Porsild 11789* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Porsild 11829* (Can.).

Occasional to common on the north slope of Colonel Mt., but not seen elsewhere in the Brintnell L. region; mature in August.

**Carex capitata** L. Syst. Nat. ed. 10, 1261 (1759); Mackenzie in N. Am. Fl. **18**: 22 (1931); Porsild in Nat. Mus. Can. Bull. **101**: 16 (1945).

Sekwi R., Canol Rd., mi. 174 E., *Porsild 11854* (Can.).

**Carex pyrenaica** Wahl. in Vet. Akad. Handl. (Stockh.) **24**: 139 (1803); Hultén, Fl. Alaska & Yuk. Pt. 2: 308 (1942), in part; Mackenzie in N. Am. Fl. **18**: 26 (1931); Porsild in Nat. Mus. Can. Bull. **101**: 16 (1945).

Damp stony beach at Camp Pt., Brintnell L., *9165;* along rocky stream in upper valley of Frost Cr., north of Brintnell L. camp, alt. 4300′–4500′, *9298, 9535;* Fort Norman, *Richardson* (G, N); Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11203* (Can.).

Common in the alpine site at Brintnell L., but rare at lake level; mature about mid-July.

**Carex incurva** Lightf. Fl. Scot. 544, *pl. 24, f. 1* (1777); Richardson, Arct. Search. Exp. **2**: 345 (1851); Mackenzie in N. Am. Fl. **18**: 31 (1931).

This species was noted by Richardson (l. c.) as occurring in the "Valleys of the Saskatchewan and Mackenzie," and there are Richardson specimens from Great Bear L. in Herb. G. Mackenzie stated that he had seen material from "Mackenzie," presumably the Richardson specimens just mentioned. Otherwise we have no records for it in the Mackenzie basin.

**Carex siccata** Dewey in Am. Jour. Sci. **10**: 278, *pl. F, f. 18* (1826); Mackenzie in N. Am. Fl. **18**: 39 (1931).

Dry upland woods west of Mackenzie R. near Simpson, *9901.*

Common; achenes mature in late August.

**Carex chordorrhiza** Ehrh. in L. f. Suppl. Pl. Syst. Veg. 414 (1781); Mackenzie in N. Am. Fl. **18**: 41 (1931); Hultén, Fl. Alaska & Yuk. Pt. 2: 315 (1942); Porsild in Sargentia **4**: 17 (1943).

This species has not yet been collected in the upper Mackenzie valley, though it has been found at L. Athabaska (Raup in Jour. Arn. Arb. **17**: 213), and at Great Bear L. and in the lower Mackenzie country (Porsild l. c.).

**Carex diandra** Schrank, Cent. Bot. Anmerk. 49 (1781); Mackenzie in N. Am. Fl. **18**: 72 (1931); Hultén, Fl. Alaska & Yuk. Pt. 2: 316 (1942); Porsild in Sargentia **4**: 17 (1943).

Boggy swamp at west end of Brintnell L., *9453.*

Common, forming dense tussocks near the edge of the lake; fruit maturing about mid-July. Common throughout the Athabaska–Great Slave L. region (Raup in Jour. Arn. Arb. **17**: 213), and collected by Porsild (l. c.) at Great Bear L.

**Carex disperma** Dewey in Am. Jour. Sci. **8**: 266 (1824); Hooker, Fl. Bor.-Am. **2**: 211 (1839); Mackenzie in N. Am. Fl. **18**: 85 (1931); Hultén, Fl. Alaska & Yuk. Pt. 2: 327 (1942); Porsild in Sargentia **4**: 17 (1943).

Margin of swamp in woods near Simpson, *9112*.

Occasional in the Simpson area; with flowers and young fruit in mid-June. Noted in Fl. Bor.-Am. as "Common in British America." Common in muskeg thickets in the Athabaska–Great Slave L. region (Raup in Jour. Arn. Arb. **17**: 214), and collected by Porsild (l. c.) at Aklavik and Great Bear L.

**Carex tenuiflora** Wahl. in Vet. Akad. Handl. (Stockh.) **24**: 147 (1803); Mackenzie in N. Am. Fl. **18**: 86 (1931); Raup in Jour. Arn. Arb. **17**: 214 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 328 (1942); Porsild in Sargentia **4**: 18 (1943).

Occasional in the Athabaska–Great Slave L. region, on the lower Mackenzie, and at Great Bear L., but not yet collected along the upper Mackenzie.

**Carex loliacea** L. Sp. Pl. 974 (1753); Mackenzie in N. Am. Fl. **18**: 87 (1931); Hultén, Fl. Alaska & Yuk. Pt. 2: 328 (1942).

Wet muskeg thickets in the valley west of Brintnell L., *9249, 9487;* damp stony shore of Brintnell L. at Camp Pt., *9194*.

Occasional to common at or near lake-level, but not seen at higher elevations; mature about mid-July.

**Carex bipartita** All. Fl. Ped. **2**: 265, *pl. 89, f. 5* (1785); Mackenzie in N. Am. Fl. **18**: 88 (1931). See Bull. Torr. Bot. Cl. **50**: 348–349 (1923).

*Carex Lachenalii* Schk.; Hultén, Fl. Alaska & Yuk. Pt. 2: 320 (1942); Porsild in Nat. Mus. Can. Bull. **101**: 16 (1945).

Dry shale slope on south side of Red Mt., alt. 5000′, *9746;* along small stream, east slope of Red Mt., alt. 4500′, *9296*.

Occasional in the Brintnell L. area; found in anthesis in late June and early August. Noted by Porsild as common in Macmillan Pass along the Canol Rd., mi. 225 E.

**Carex bonanzensis** Britton in Bull. N. Y. Bot. Gard. **2**: 160 (1901); Porsild in Sargentia **4**: 18 (1943).

Wet woods near Simpson, *9091*.

*Carex bonanzensis* was described from the upper Yukon region, and has been found in the Mackenzie region at only two places, Simpson and in the Mackenzie delta (*Porsild 6879*, Can.). It is closely related to *C. canescens*, but differs from the latter in having brown scales with prominent green mid-ribs and in producing somewhat smaller perigynia.

**Carex canescens** L. Sp. Pl. 974 (1753); Mackenzie in N. Am. Fl. **18**: 95 (1931); Hultén, Fl. Alaska & Yuk. Pt. 2: 324 (1942); Porsild in Nat. Mus. Can. Bull. **101**: 16 (1945).

*Carex curta* sensu Boott in Hooker, Fl. Bor.-Am. **2**: 214 (1839), in part, non Good.

Damp stony beach at Camp Pt., Brintnell L., *9196;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11216* (Can.).

Occasional at Brintnell L.; in anthesis late in June. The note in Fl. Bor.-Am., "Common in British America," probably refers in part also to the following.

**Carex canescens** L. var. **subloliacea** (Laestad.) Hartm. Handb. Skand. Fl. ed. 4, 299 (1843); Raup in Jour. Arn. Arb. **17:** 214 (1936).

*Carex canescens* L. f. *subloliacea* Laestad in Nova Acta Soc. Sci. Upsal. **11:** 282 (1839).

*Carex curta* sensu Boott in Hooker, Fl. Bor.-Am. **2:** 214 (1839), in part, non Good.

Twelve mi. east of Moraine Pt., northwest shore of Great Slave L., *Bedford* (Can.).

Common in the Athabaska–Great Slave L. region.

**Carex gynocrates** Wormsk. in Drejer, Nat. Tidssk. **3:** 434 (1841); Mackenzie in N. Am. Fl. **18:** 98 (1931); Raup in Jour. Arn. Arb. **17:** 214 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 302 (1942); Porsild in Nat. Mus. Can. Bull. **101:** 16 (1945).

*Carex dioica* sensu Boott in Hooker, Fl. Bor.-Am. **2:** 208 (1839), non L.

Wet mossy muskeg near east end of Brintnell L., *9353, 9577, 9581;* Plains of Abraham, Canol Rd., alt. 6000′, *Porsild 11795* (Can.).

Common; mature in late July. Porsild also noted it along a small tributary to Little Keele R. along the Canol Rd., mi. 51 E. In Fl. Bor.-Am. it is said to occur from "Carleton House to the Arctic Sea." Our *9581* has unusually short perigynia, scarcely longer than the scales. They are somewhat more abruptly beaked than the typical form, and the beaks are not so prominently deflexed at maturity.

**Carex Macloviana** d'Urv. in Mem. Soc. Linn. Paris **4:** 599 (1826); Mackenzie in N. Am. Fl. **18:** 126 (1931); Porsild in Nat. Mus. Can. Bull. **101:** 16 (1945).

*Carex festiva* Dewey; Boott in Hooker, Fl. Bor.-Am. **2:** 215 (1839), in part.

Mackenzie R., between Blackwater R. and Norman, *Crickmay 159* (Can.); Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11211* (Can.).

The record under *C. festiva* in Fl. Bor.-Am., "Cumberland House, Bear Lake," probably refers in part to this species. Hultén (Fl. Alaska & Yuk. Pt. 2: 318) apparently considers that northwestern American material of the *C. Macloviana* complex represents ssp. *pachystachya* (Cham.) Hultén (l. c.). Mackenzie, however, maintains the two as separate species, the latter distinguished by its plano-convex perigynia with beak inconspicuously white-hyaline-tipped. According to Mackenzie, *C. Macloviana* has the body of its perigynia concave ventrally, with the beak strongly white-hyaline-tipped.

**Carex phaeocephala** Piper in Contr. U. S. Nat. Herb. **11:** 172 (1906); Hultén, Fl. Alaska & Yuk. Pt. 2: 319 (1942).

Shale rock-slides and rocky stream channels on summit and upper slopes of Red Mt., alt. 4300′–5900′, *9297, 9529, 9531, 9772, 9780, 9795.*

Common above timber-line on Red Mt., but not seen elsewhere in the Brintnell L. district. In anthesis late in June. Our specimens have darker scales (some of them almost black) than most of the material in the Gray Herbarium. The scales, except the lowermost in the spikes, have margins slightly if at all hyaline, and the beaks of the perigynia are only slightly hyaline at the tips. Descriptions of both *C. phaeocephala* and the closely related *C. platylepis* (cf. Mackenzie in N. Am. Fl. **18:** 139, 142) state that these species have prominent, hyaline margins on the scales; but in the material at the Gray Herbarium there is considerable variability in this character. Our plants are therefore placed here until further study proves whether or not they are worthy of segregation.

**Carex Soperi** sp. nov. FIG. 12.

Culmi 20–35 cm. alti, e rhizomatibus squamosis 2 mm. crassis singillatim vel pauci-aggregatim adscendentes, graciles sed rigidi, acute 3-angulati, supra scabri; foliis e culmis basim versus plerumque adscendentibus, pallido-viridibus, 6–15 mm. longis, 2.5–3 mm. latis, planis, longo-acuminatis, 3 vel 4 per culmum fer-

tilem, vaginis ventro albo-hyalinis; capitulis dense aggregatis ovatis; spicis circa 5, gynocandris; perigyniis atro-rubro-fuscis, margine submigris, late ovatis, alatis, 3.5–4 mm. longis, 1–1.5 mm. latis, ad rostrum circiter 0.6 mm. longum rotundatum contractis, dorso plurinerviis, ventro leviter paucinerviis, parte superiore alae et rostri subtiliter serrulata, rostro atro-fusco vel nigro apice obliquo; squamis costa subviridi et margine angusto hyalino exceptis atro-rubro-fuscis vel nigris, longitudine corpore perigynii subaequalibus latitudine angustioribus; acheniis lenticularibus, stigmatibus 2.

Damp grassy place in willow-birch scrub, upper valley of Frost Cr., north of Brintnell L., alt. 4000′, *9534* (TYPE).

Common in this situation but not seen elsewhere. In flower characters and the general appearance of leaves and culms these plants closely resemble *C. festivella* Mackenzie, but they differ from this as well as from most of the section *Ovales* in being non-caespitose. The culms rise singly or few together at intervals of several inches, and must be collected individually like those of *C. siccata*.

**Carex praticola** Rydb. in Mem. N. Y. Bot. Gard. **1:** 84 (1900); Mackenzie in N. Am. Fl. **18:** 140 (1931); Hultén, Fl. Alaska & Yuk. Pt. 2: 319 (1942).

Cultivated field at Simpson, *9140;* Mackenzie R., between Blackwater R. and Norman, *Crickmay 157* (Can.).

Common at Simpson; in anthesis about mid-June.

**Carex Crawfordii** Fernald in Proc. Am. Acad. **37:** 469, *pl. 1, f. 12, 13* (1902); Mackenzie in N. Am. Fl. **18:** 145 (1931); Raup in Jour. Arn. Arb. **17:** 215 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 320 (1942).

"Carlton House to Bear Lake," *Richardson* (G).

In Fl. Bor.-Am. this species was probably included in *C. scoparia,* which was noted as "Common in British America." It is common about L. Athabaska, but the above records are the only evidence for its presence in southwestern Mackenzie.

**Carex Bebbii** Olney (Caric. Bor.-Am. 3, name only, 1871; L. H. Bailey in Mem. Torr. Bot. Cl. **1:** 55, as synonym, 1889); Fernald in Proc. Am. Acad. **37:** 478 (1902).

Muskeg along road west of the Mackenzie R. near Simpson, *9899;* upland prairie west of the Mackenzie R., near Simpson, *9889.*

Occasional; fruit mature in late August.

**Carex aenea** Fernald in Proc. Am. Acad. **37:** 480, *pl. 3, f. 65, 66* (1902); Mackenzie in N. Am. Fl. **18:** 169 (1935); Hultén, Fl. Alaska & Yuk. Pt. 2: 320 (1942).

Southerly slope in an old field at Simpson, *9136.*

Occasional; in anthesis about mid-June. This material is very young and is placed here tentatively. Its inflorescences are rather stiff for *C. aenea,* though this is a common condition in young plants. Number *9136* matches specimens collected on L. Athabaska in 1935 (Raup in Jour. Arn. Arb. **17:** 215).

**Carex leptalea** Wahl. in Vet. Akad. Handl. (Stockh.) **24:** 139 (1803); Mackenzie in N. Am. Fl. **18:** 173 (1935); Hultén, Fl. Alaska & Yuk. Pt. 2: 306 (1942).

Mackenzie R., *Richardson* (N); damp place in upland prairie west of Mackenzie R. near Simpson, *9902.*

Occasional in the Simpson area and observed once at Brintnell Lake; fruit maturing in late August. Occasional also in the Athabaska–Great Slave L. region (Raup in Jour. Arn. Arb. **17:** 215), and collected at Great Bear L. by Porsild (Sargentia **4:** 18).

FIG. 12. *Carex Soperi* Raup, sp. nov.

**Carex obtusata** Liljebl. in Vet. Akad. Handl. (Stockh.) **14:** 69, *t. 4* (1793); Mackenzie in N. Am. Fl. **18:** 181 (1935); Hultén, Fl. Alaska & Yuk. Pt. 2: 305 (1942); Porsild in Sargentia **4:** 18 (1943).

This species has not yet been observed in the upper Mackenzie country, but is common in parts of the Athabaska–Great Slave L. region (Raup in Jour. Arn. Arb. **17:** 215) and along the lower Mackenzie (Porsild, l. c.).

**Carex supina** Willd. ssp. **spaniocarpa** (Steud.) Hultén, Fl. Alaska & Yuk. Pt. 2: 365 (1942).

*Carex spaniocarpa* Steud. Synop. Cyp. 225 (1855).

*Carex supina* Willd. ex Wahl.; Mackenzie in N. Am. Fl. **18:** 182 (1935); Raup in Jour. Arn. Arb. **17:** 215 (1936).

Known in the Athabaska–Great Slave L. region (Raup, l. c.) and at Great Bear L. (*Richardson,* G, N), but not yet collected in the upper Mackenzie country.

**Carex deflexa** Hornem. Dansk. Oecon. Pl. ed. 3, **1:** 938 (1821); Mackenzie in N. Am. Fl. **18:** 199 (1935); Hultén, Fl. Alaska & Yuk. Pt. 2: 263 (1942).

Pebbly beach on shore of Brintnell L., *9167;* along small stream, east slope of Red Mt., alt. 4500′, *9284.*

Common in the above situations but not seen elsewhere; spikes well developed in late June.

**Carex Rossii** Boott in Hooker, Fl. Bor.-Am. **2:** 222 (1839); Mackenzie in N. Am. Fl. **18:** 201 (1935); Raup in Jour. Arn. Arb. **17:** 216 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 364 (1942).

This species has been collected just at the southeastern corner of our region, at Fort Smith (*Raup 326*).

**Carex tonsa** (Fernald) Bickn. in Bull. Torr. Bot. Cl. **35:** 492 (1908); Mackenzie in N. Am. Fl. **18:** 205 (1935). See Fernald in Rhod. **44:** 288–290 (1942).

*Carex umbellata* sensu Boott in Hooker, Fl. Bor.-Am. **2:** 222 (1839), in part; Richardson in Arct. Search. Exp. **2:** 344 (1851); non Schk.

*Carex umbellata* Schk. var. *tonsa* Fernald in Proc. Am. Acad. **37:** 507 (1902); Raup in Jour. Arn. Arb. **17:** 216 (1936).

This plant was noted by Richardson (l. c.) at Methye Portage and Fort Simpson, as *C. umbellata.* As such it was noted in Fl. Bor.-Am. as occurring in "British America." I have seen a Richardson specimen from Chipewyan (Herb. G), and have collected the species on the south shore of L. Athabaska (*6724*). Both of these specimens represent var. *tonsa.* The Simpson record made by Richardson, presumably also the variety, is the only evidence we have of the plant north of Athabaska L.

**Carex scirpoidea** Michx. Fl. Bor.-Am. **2:** 171 (1803); Boott in Hooker, Fl. Bor.-Am. **2:** 208 (1839); Macoun, Cat. Can. Pl. Pt. 4: 112 (1888); Mackenzie in N. Am. Fl. **18:** 207 (1935); Raup in Jour. Arn. Arb. **17:** 216 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 303 (1942); Porsild in Nat. Mus. Can. Bull. **101:** 16, 30 (1945).

Northwest shore of Great Slave L., *Bedford* (Can.); Mackenzie R., *Richardson* (N); Mackenzie R., Wrigley to Blackwater R., *Crickmay 129* (Can.); Blackwater R. to Norman, *Crickmay 156* (Can.); Norman, *Richardson* (N); mossy thickets along south shore of Brintnell L., *9363, 9364;* south slope of Red Mt., alt. 4600′, *9231;* north slope of Colonel Mt., alt. 3500′–5500′, *9395, 9626;* north peak, Nahanni Mt., *Wynne-Edwards 8431* (Can.); Lone Mt., *Wynne-Edwards 8432* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8252, 8253, 8254* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11853* (Can.).

Occasional to common on the shores of Brintnell L., particularly on north exposures. On the cold north slope of Colonel Mt. it is abundant, and above

timber line it becomes a primary species on turfy slopes. It is also a predominant species on parts of the south slope of Red Mt. In anthesis in July.

**Carex concinna** R. Br. apud Richardson, Bot. App. Frankl. Journ. 751 (1823); Boott in Hooker, Fl. Bor.-Am. **2:** 223 (1839); Macoun, Cat. Can. Pl. Pt. 4: 158 (1888); Mackenzie in N. Am. Fl. **18:** 212 (1935); Raup in Jour. Arn. Arb. **17:** 216 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 365 (1942); Porsild in Nat. Mus. Can. Bull. **101:** 30 (1945).

Mackenzie R., *Richardson* (N); muskeg thickets at west end of Brintnell L., *9250;* north peak, Lone Mt., *Wynne-Edwards 8429, 8430* (Can.); dry dolomitic summit of Nahanni Mt., *Wynne-Edwards 8428* (Can.).

Common in the Brintnell Lake habitat noted above, but not seen elsewhere in the district; fruit maturing in late June. Noted in Fl. Bor.-Am. from "Cumberland House to Mackenzie River." Porsild (Sargentia **4:** 18) has collected it at Great Bear L. and in the lower Mackenzie region.

**Carex Richardsonii** R. Br. apud Richardson, Bot. App. Frankl. Journ. 751 (1823); Mackenzie in N. Am. Fl. **18:** 213 (1935); Raup in Jour. Arn. Arb. **17:** 216 (1936).

Fort Smith, Slave R., *Raup 303, 1885.*

In the original description the locality for this species was given as "W," meaning "wooded country from latitude 54° to 64° north." Boott, in Fl. Bor.-Am., gave the locality as "Norway and Cumberland House." The species occurs rather commonly in the Wood Buffalo Park, and has been collected just within the southeast corner of our region at Ft. Smith. It undoubtedly occurs along the upper Mackenzie.

**Carex rupestris** All. Fl. Pedemont. **2:** 264, *pl. 92, f. 1* (1785); Boott in Hooker, Fl. Bor.-Am. **2:** 209 (1839); Macoun, Cat. Can. Pl. Pt. 4: 113 (1888); Mackenzie in N. Am. Fl. **18:** 220 (1935); Hultén, Fl. Alaska & Yuk. Pt. 2: 304 (1942); Porsild in Nat. Mus. Can. Bull. **101:** 16 (1945).

Norman, *Richardson* (G); Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11791* (Can.).

Collected by Porsild (Sargentia **4:** 18) also at Great Bear L. and in the lower Mackenzie country.

**Carex glacialis** Mackenzie in Bull. Torr. Bot. Cl. **37:** 244 (1910); Mackenzie in N. Am. Fl. **18:** 221 (1935); Hultén, Fl. Alaska & Yuk. Pt. 2: 366 (1942); Porsild in Nat. Mus. Can. Bull. **101:** 16 (1945).

Bald limestone mountain on Plains of Abraham, Canol Rd., *Porsild 11790* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11849* (Can.).

**Carex eburnea** Boott in Hooker, Fl. Bor.-Am. **2:** 226, *pl. 225* (1839); Macoun, Cat. Can. Pl. Pt. 4: 157 (1888); Mackenzie in N. Am. Fl. **18:** 223 (1935); Raup in Jour. Arn. Arb. **17:** 216 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 366 (1942); Porsild in Nat. Mus. Can. Bull. **101:** 16, 30 (1945).

Norman, *Richardson,* June, 1826 (G, N) (apparently part of the type material); north face of Lone Mt., *Wynne-Edwards 8434* (Can.); mossy slopes on summit of Lone Mt., *Wynne-Edwards 8435* (Can.); Sekwi R., Canol Rd., mi. 174 E., alt. 3625′, *Porsild 11947* (Can.).

Widely distributed in the central and northern parts of the Mackenzie basin, apparently confined to limestone or dolomitic rocks (Raup, l. c.; Porsild in Sargentia **4:** 19).

**Carex Garberi** Fernald var. **bifaria** Fernald in Rhod. **37:** 255 (1935); Hultén, Fl. Alaska & Yuk. Pt. 2: 333 (1942).

*Carex Hassei* sensu Mackenzie in N. Am. Fl. **18:** 233 (1935), at least in part, non Bailey.

Stony beaches near west end of Brintnell L., *9174.*

Common in this habitat; perigynia beginning to mature in the last week of June. Specimens representing the typical form have been collected at Great Slave L. (Raup in Jour. Arn. Arb. **17**: 217), but the northwestern extent of these forms is yet uncertain. Porsild (Sargentia **4**: 19) reports *C. Garberi,* presumably in its typical form, at Great Bear L. and in the Mackenzie delta.

**Carex aurea** Nutt. Gen. **2**: 205 (1818); Mackenzie in N. Am. Fl. **18**: 234 (1935); Raup in Jour. Arn. Arb. **17**: 217 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 332 (1942).

Fort Smith, *Raup 295;* Mackenzie R., *Richardson* (G); upland prairie west of Mackenzie R., near Simpson, *9934;* wet mossy muskeg thickets at west end of Brintnell L., *9721.*

Common; mature in August. The plants collected at Brintnell L. are characterized by distinctly pear-shaped perigynia. This form is nearly all lost in drying. The Simpson specimens, as well as others collected in the Mackenzie basin earlier, all have well-rounded perigynia. Mackenzie (l. c.) describes the species as having orbicular-obovoid perigynia and says nothing about a pyriform tendency, although he cites *C. pyriformis* Schw. as a synonym. Schweinitz described this as having "capsules pyriform" (Ann. Lyc. N. Y. **1**: 69, 1824), but later he reduced it, himself, to *C. aurea.* Whether or not the form is worthy of recognition can be decided only after more field notes on the shape of the perigynia have accumulated, especially since the character is largely lost in drying.

**Carex vaginata** Tausch in Flora **4**: 557 (1821); Macoun, Cat. Can. Pl. Pt. 4: 153 (1888); Raup in Jour. Arn. Arb. **17**: 217 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 372 (1942); Porsild in Nat. Mus. Can. Bull. **101**: 16, 30 (1945).

*Carex saltuensis* Bailey, Macoun, Cat. Can. Pl. Pt. 5: 282 (1890); Mackenzie in N. Am. Fl. **18**: 241 (1935).

*Carex phaeostachya* sensu Boott in Hooker, Fl. Bor.-Am. **2**: 226 (1839), in part, non Smith.

Damp mossy thickets and gravel shores around Brintnell L., *9248, 9360;* mossy banks in willow-birch scrub near iron spring near west end of Brintnell L., *9528;* open mossy woods on north slope of Colonel Mt., *9419;* north peak of Nahanni Mt., alt. 2500′, *Wynne-Edwards 8436* (Can.); Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11794* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8255, 8256, 8257* (Can.).

Occasional to common around the shore of Brintnell L., and very common on the north-facing slope of Colonel Mt. up to about 3500′; mature in the latter part of July. Noted in Fl. Bor.-Am. at "Fort Norman, Mackenzie River."

**Carex capillaris** L. Sp. Pl. 977 (1753); Boott in Hooker, Fl. Bor.-Am. **2**: 227 (1839); Macoun, Cat. Can. Pl. Pt. 4: 163 (1888); Mackenzie in N. Am. Fl. **18**: 295 (1935); Raup in Jour. Arn. Arb. **17**: 217 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 374 (1942); Porsild in Nat. Mus. Can. Bull. **101**: 16, 30 (1945).

Norman, *Richardson* (G, N); wet mossy banks and muskeg thickets around Brintnell L., *9173, 9244;* north peak of Nahanni Mt., *Wynne-Edwards 8437* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8260* (Can.); Sekwi R., Canol Rd., alt. 3625′, mi. 174 E., *Porsild 11852* (Can.); Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11209* (Can.).

Common to abundant in the Brintnell L. habitats; mature late in July.

**Carex Oederi** Retz. var. **viridula** (Michx.) Kükenth. in Pflanzenr. **38** (IV. 20): 674 (1909); Hultén, Fl. Alaska & Yuk. Pt. 2: 377 (1942).

*Carex viridula* Michx. Fl. Bor.-Am. **2**: 170 (1803); Mackenzie in N. Am. Fl. **18**: 303 (1935).

*Carex Oederi* Retz. var. *pumila* (Cosson & Germ.) Fernald in Rhod. **8**: 201 (1906); Raup in Jour. Arn. Arb. **17**: 217 (1936); Porsild in Sargentia **4**: 19 (1943).

This species has not yet been observed along the upper Mackenzie, but it has been collected at Great Slave (Raup, l. c.) and Great Bear (Porsild, l. c.) Lakes.

**Carex petricosa** Dewey in Am. Jour. Sci. **29**: 246, *pl. W, f. 70* (1836); Porsild in Sargentia **4**: 19 (1943), in Nat. Mus. Can. Bull. **101**: 16, 30 (1945).

Lone Mt., *Wynne-Edwards 8438* (Can.); north peak, Nahanni Mt., *Wynne-Edwards 8439* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alt. 4420′, *Porsild 11830* (Can.); same place, *Wynne-Edwards 8251* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11848* (Can.).

**Carex misandra** R. Br. App. Parry's Voy. 283 (1823); Mackenzie in N. Am. Fl. **18**: 312 (1935); Hultén, Fl. Alaska & Yuk. Pt. 2: 273 (1942); Porsild in Nat. Mus. Can. Bull. **101**: 16 (1945).

Plains of Abraham, Canol Rd., mi. 82 E., alt. 6000′, *Porsild 11792* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8247, 8248, 8249, 8250* (Can.).

Porsild (l. c.) noted the species also in Macmillan Pass at mi. 219 E.

**Carex atrofusca** Schk. Riedgr. 106, *pl. Y, f. 82* (1801); Mackenzie in N. Am. Fl. **18**: 313 (1935); Hultén, Fl. Alaska & Yuk. Pt. 2: 373 (1942); Porsild in Sargentia **4**: 20 (1943), in Nat. Mus. Can. Bull. **101**: 16 (1945).

Bald limestone mountain on Plains of Abraham, Canol Rd., alt. 6000′, mi. 82 E., *Porsild 11793* (Can.).

**Carex lasiocarpa** Ehrh. var. **americana** Fernald in Rhod. **44**: 304 (1942).

*Carex lasiocarpa* Ehrh. sensu Mackenzie in N. Am. Fl. **18**: 330 (1935); Raup in Jour. Arn. Arb. **17**: 217 (1936).

Evidence for the occurrence of *C. lasiocarpa* in southwestern Mackenzie is very scanty. A record in Fl. Bor.-Am. under the closely related *C. lanuginosa* Michx. reads "Canada to Mackenzie River." The latter species apparently has not been collected anywhere in the Mackenzie basin, but *C. lasiocarpa* has proved to be abundant on the south shore of Lake Athabaska (Raup, l. c.) and probably will be found farther northward. It is possible that the early note in Fl. Bor.-Am. refers to it.

**Carex rariflora** (Wahl.) Smith in Engl. Bot. *pl. 2516* (1813); Boott in Hooker, Fl. Bor.-Am. **2**: 224 (1839); Macoun, Cat. Can. Pl. Pt. 4: 150 (1888); Mackenzie in N. Am. Fl. **18**: 348 (1935); Hultén, Fl. Alaska & Yuk. Pt. 2: 367 (1942); Porsild in Nat. Mus. Can. Bull. **101**: 16 (1945).

"Mackenzie River ex Boott" (G); "Fort Franklin," *Richardson* (N); arctic tundra at east end of Macmillan Pass, Canol Rd., mi. 204 E., *Porsild 11885* (Can.).

Noted in Fl. Bor.-Am. at "Fort Franklin, Mackenzie River."

**Carex limosa** L. Sp. Pl. 977 (1753); Boott in Hooker, Fl. Bor.-Am. **2**: 224 (1839); Mackenzie in N. Am. Fl. **18**: 350 (1935); Raup in Jour. Arn. Arb. **17**: 218 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 369 (1942); Porsild in Sargentia **4**: 20 (1943).

This species has not been collected in the upper Mackenzie country, though it is to be expected there. It is occasional throughout much of the Athabaska–Great Slave L. region (Raup, l. c.), and has been collected by Porsild (l. c.) at Great Bear L. and in the Eskimo Lakes basin.

**Carex paupercula** Michx. var. **irrigua** (Wahl.) Fernald in Rhod. **8**: 76 (1906); Raup in Jour. Arn. Arb. **17**: 218 (1935).

*Carex limosa* L. var. *irrigua* Wahl. Act. Holm. 162 (1803).

*Carex magellanica* sensu Hultén, Fl. Alaska & Yuk. Pt. 2: 370 (1942), non Lam.

*Carex paupercula* Michx. sensu Mackenzie in N. Am. Fl. **18**: 351 (1935); Porsild in Sargentia **4**: 20 (1943).

This species has been collected in the Athabaska–Great Slave L. region (Raup, l. c.) and at Great Bear L. (Porsild, l. c.), but has not been seen along the upper Mackenzie.

**Carex media** R. Br. apud Richardson, Bot. App. Frankl. Journ. 750 (1823); Porsild in Sargentia **4**: 20 (1943), in Nat. Mus. Can. Bull. **101**: 16 (1945). See Rhod. **35**: 220–223 (1933), **41**: 203–205 (1939), **44**: 303–304 (1942).

*Carex Vahlii* sensu Boott in Hooker, Fl. Bor.-Am. **2**: 216 (1839); Mackenzie in N. Am. Fl. **18**: 357 (1935); non Schk.

*Carex Vahlii* Schk. var. *inferalpina* (Wahl.) Fernald; Raup in Jour. Arn. Arb. **17**: 218 (1936).

*Carex norvegica* Retz. ssp. *inferalpina* (Wahl.) Hultén, Fl. Alaska & Yuk. Pt. 2: 348 (1942).

*Carex alpina* sensu Macoun, Cat. Can. Pl. Pt. 4: 136 (1888), non Liljebl.

Damp roadway in lowland woods near Simpson, *9092;* stony beaches and muskeg shores of Brintnell L., *9170, 9175, 9197, 9362;* Macmillan Pass, Canol. Rd., mi. 225 E., *Porsild 11208* (Can.).

Common in muskeg thickets at Brintnell L., but rare or occasional elsewhere in the vicinity; mature in July. In Fl. Bor.-Am. *C. Vahlii* is noted as "Common in British America, to the Arctic Coast." Porsild (Sargentia **4**: 20) notes *C. media* as common in the wooded country of the Mackenzie northward to the delta, and at Great Bear L.

**Carex nesophila** Holm in Am. Jour. Sci. IV. **17**: 315 (1904); Porsild in Nat. Mus. Can. Bull. **101**: 16 (1945).

Grassy meadow on north slope of Colonel Mt., alt. 5000′, *9613;* loose shale on summit of Red Mt., alt. 5900′, *9789;* mountain slope south of Little Keele R., Canol Rd., mi. 55 E., *Porsild 11784* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8258* (Can.).

Common locally on the mountains at Brintnell L.; found flowering in late July and early August.

**Carex podocarpa** R. Br. apud Richardson, Bot. App. Frankl. Journ. 751 (1823); Boott in Hooker, Fl. Bor.-Am. **2**: 224 (1839); Macoun, Cat. Can. Pl. Pt. 4: 149 (1888); Mackenzie in N. Am. Fl. **18**: 362 (1935); Hultén, Fl. Alaska & Yuk. Pt. 2: 362 (1942); Porsild in Nat. Mus. Can. Bull. **101**: 17 (1945). See Porsild in Rhod. **41**: 205–206 (1939).

Shale slides and turfy slopes, south side of Red Mt., alt. 5000′–5800′, *9752, 9793;* northeast and east slopes of Red Mt., alt. 4500′–5500′, *9283, 9788;* west slope of Terrace Mt., alt. 4500′–5000′, *9538;* Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8259* (Can.).

Occasional to common on south- and west-facing alpine slopes at Brintnell L., but abundant on the north and east sides of Red Mt. Here it is one of the most prominent species in the turf. In flower late in June; mature early in August. Porsild (1. c.) notes it as common in Macmillan Pass and elsewhere along the Canol Rd.

**Carex atrata** L. ssp. **atrosquama** (Mackenzie) Hultén, Fl. Alaska & Yuk. Pt. 2: 354 (1942).

*Carex atrosquama* Mackenzie in Proc. Biol. Soc. Wash. **25**: 51 (1912), in N. Am. Fl. **18**: 366 (1935); Porsild in Sargentia **4**: 21 (1943), in Nat. Mus. Can. Bull. **101**: 17 (1945).

Pebble beaches and stony thickets, shore of Brintnell L., *9164;* grassy meadow, north slope of Colonel Mt., alt. 5000′, *9614;* south slope of Red Mt., in damp thickets, *9233;* springy place in birch scrub, upper valley of Frost Cr., alt. 4500′, *9517;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11215* (Can.).

Occasional to common in the Brintnell L. sites; collected with immature perigynia late in July. Mackenzie described this species from northern Rocky Mountain material, stating that it differs from *C. atrata* L. and others of this relationship in having somewhat inflated perigynia (little flattened at maturity) and the peri-

gynia not much broader than the achenes. There is a large series of Eursian *C. atrata* in the Gray Herbarium; and on these the mature achenes are often inflated and scarcely margined by compression. In fact our material is a good match for many of the old-world specimens. There seems to be a tendency to smaller spikes and shorter bracts on the American plants, but I am inclined to agree with Hultén that they should be recognized at most as a subspecies.

**Carex albo-nigra** Mackenzie in Rydb. Fl. Rocky Mts. 137 (1917); Mackenzie in N. Am. Fl. **18:** 369 (1935); Hultén, Fl. Alaska & Yuk. Pt. 2: 353 (1942).

Shale slide rock on south slope of Red Mt., near summit, alt. 5900′, *9745*.

Common; fruit mature early in August. Some of our plants have unusually long lateral spikes (2 cm.), on peduncles that are somewhat longer. Mackenzie characterizes the species (N. Am. Fl. **18**: 369) as having lateral spikes 8–10 mm. long, on erect peduncles shorter than the spikes. The lowest spike on some of our specimens is attenuate, with flowers widely separate. This tendency toward elongated spikes is also seen in plants from the Rocky Mountains of the upper Peace River region (*Raup & Abbe 4129*). Other specimens in no. *9745* match the typical forms.

**Carex atratiformis** Britton in Bull. Torr. Bot. Cl. **22**: 222 (1895); Mackenzie in N. Am. Fl. **18**: 372 (1935); Raup in Jour. Arn. Arb. **17**: 218 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 355 (1942).

This species is occasional in the Wood Buffalo Park, and was collected along the Frances R. by Dawson in 1887 (Can.). It is to be expected along the upper Mackenzie and lower Liard Rivers.

**Carex Buxbaumii** Wahl. in Vet. Akad. Handl. (Stockh.) **24**: 163 (1803); Mackenzie in N. Am. Fl. **18:** 374 (1935); Raup in Jour. Arn. Arb. **17:** 218 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 350 (1942); Porsild in Sargentia **4:** 21 (1943).

Known in the Wood Buffalo Park, at Great Bear L., and in Alaska, but not yet collected along the upper Mackenzie.

**Carex lenticularis** Michx. Fl. Bor.-Am. **2:** 172 (1803); Boott in Hooker, Fl. Bor.-Am. **2:** 219 (1839); Macoun, Cat. Can. Pl. Pt. 4: 145 (1888); Mackenzie in N. Am. Fl. **18:** 385 (1935); Raup in Jour. Arn. Arb. **17:** 219 (1936).

This species was noted in Fl. Bor.-Am. as occurring from "Canada to Mackenzie River." It is occasional in the Athabaska–Great Slave L. region, and there are several Richardson specimens in Herbs. G and N from Great Bear L. It is to be expected, therefore, in southwestern Mackenzie.

**Carex aquatilis** Wahl. in Vet. Akad. Handl. (Stockh.) **24:** 165 (1803); Boott in Hooker, Fl. Bor.-Am. **2:** 219 (1839); Macoun, Cat. Can. Pl. Pt. 4: 143 (1888); Mackenzie in N. Am. Fl. **18:** 396 (1935); Raup in Jour. Arn. Arb. **17:** 219 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 338 (1942); Porsild in Sargentia **4:** 23 (1943). See Fernald in Rhod. **44**: 295–298 (1942).

Northwest shore of Great Slave L., *Bedford* (Can.); Rae, *Bedford* (Can.); Mackenzie R., *Richardson* (G); wet gravelly and marshy shores of Brintnell L., *9311, 9497;* recently formed mud flat at west end of Brintnell L., *9706*.

Common to abundant; fruit mature in late July and early August. A primary species on marshy ground at the lake shore, where it is associated with *Calamagrostis neglecta* and *C. canadensis* var. *robusta.* Noted by Richardson (Arct. Search. Exp. **2**: 344–345) at Simpson, and in Fl. Bor.-Am. from "Canada to

Mackenzie River." Porsild states that it is common throughout the Mackenzie valley.

**Carex aquatilis** Wahl. var. **stans** (Drejer) Ostenf. Fl. Arct. 70, *f. 43* (1902); Hultén, Fl. Alaska & Yuk. Pt. 2: 338 (1942).

*Carex stans* Drejer, Revis. Crit. Car. 458 (1841); Porsild in Nat. Mus. Can. Bull. **101:** 17 (1945).

Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11213* (Can.).

**Carex microglochin** Wahl. in Vet. Akad. Handl. (Stockh.) **24:** 140 (1803); Mackenzie in N. Am. Fl. **18:** 424 (1935); Hultén, Fl. Alaska & Yuk. Pt. 2: 310 (1942); Porsild in Sargentia **4:** 24 (1943).

Mud flats near west end of Brintnell L., *9810.*

Occasional, forming small round colonies in an association of *Equisetum variegatum* and mosses on the recently formed deposits of glacial mud; found with mature perigynia in mid-August.

**Carex atherodes** Spreng. Syst. Veg. **3:** 828 (1826); Mackenzie in N. Am. Fl. **18:** 439 (1935); Hultén, Fl. Alaska & Yuk. Pt. 2: 384 (1942).

*Carex trichocarpa* Muhl. sensu Boott in Hooker, Fl. Bor.-Am. **2:** 222 (1839), in part.

*Carex trichocarpa* Muhl. var. *aristata* (R. Br.) Bailey; Raup in Jour. Arn. Arb. **17:** 219 (1936).

Lower Slave R., Raup *316;* Mackenzie R., *Richardson* (N); grassy swale near Ft. Liard, *Nowosad* (Can.).

This is one of the most abundant sedges in the river lowlands of the Wood Buffalo Park, and no doubt it extends far into the upper Mackenzie country. It has also been collected at Whitehorse Rapids in the upper Yukon country (Hultén, l. c.).

**Carex physocarpa** Presl. Reliq. Haenk. **1:** 205 (1830); Mackenzie in N. Am. Fl. **18:** 448 (1935); Hultén, Fl. Alaska & Yuk. Pt. 2: 380 (1942); Porsild in Sargentia **4:** 24 (1943), in Nat. Mus. Can. Bull. **101:** 17 (1945). See O'Neill & Duman in Rhod. **43:** 418–425 (1941).

Marshes and damp stony beaches, shore of Brintnell L., *9195, 9365;* wet meadow at west end of Brintnell L., *9713, 9716;* Sekwi R., Canol Rd., mi. 174 E., *Porsild 11851* (Can.); Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11206* (Can.).

Abundant in shallow water along the shores of Brintnell L., but only occasional in the other habitats mentioned; mature early in August.

This species usually develops stout rootstocks, with culms rising singly or few together. Number *9713* is distinctive in forming dense tussocks from very short crowded rootstocks.

**Carex saxatilis** L. Sp. Pl. 976 (1753); Raup in Jour. Arn. Arb. **17:** 220 (1936); Porsild in Sargentia **4:** 24 (1943).

This species has not yet been collected in the upper Mackenzie country, but it has been found at Great Slave L. (Raup, l. c.) and at Great Bear L. (Porsild, l. c.). There is also a specimen in Herb. G collected by Dutilly on the lower Mackenzie.

**Carex membranacea** Hooker, App. Parry's 2nd Voy. 406 (1825); Boott in Hooker, Fl. Bor.-Am. **2:** 220 (1839); Mackenzie in N. Am. Fl. **18:** 454 (1935); Hultén, Fl. Alaska & Yuk. Pt. 2: 382 (1942); Porsild in Nat. Mus. Can. Bull. **101:** 17 (1945).

*Carex membranopacta* Bailey; Raup in Jour. Arn. Arb. **17:** 220 (1936).

Mackenzie, 1886, *R. Bell* (Can. no. *34724*); Mackenzie R., between Wrigley and Blackwater R., *Crickmay 128* (Can.); between Blackwater R. and Norman, *Crickmay 158* (Can.);

wet mossy and gravelly banks on shore of Brintnell L., *9198, 9199, 9338;* muskeg thickets at west end of Brintnell L., *9246, 9247;* mud flat at west end of Brintnell L., *9265-A;* Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8261, 8262* (Can.); Sekwi R., Canol Rd., mi. 174 E., alt. 3625′, *Porsild 11850* (Can.); Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11202* (Can.).

Occasional to common at Brintnell L., especially in wet muskeg thickets; mature in July. Noted by Porsild along the Canol Rd., and also at Little Keele R. and the Plains of Abraham. The record in Fl. Bor.-Am. reads "Cumberland House to Arctic Coast."

**Carex rostrata** Stokes in Withering, Brit. Pl. ed. 2, **2:** 1059 (1787); Macoun, Cat. Can. Pl. Pt. 4: 170 (1888); Mackenzie in N. Am. Fl. **18:** 456 (1935); Raup in Jour. Arn. Arb. **17:** 220 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 378 (1942).

*Carex ampullacea* Good. sensu Boott in Hooker, Fl. Bor.-Am. **2:** 221 (1839).

Northwest shore of Great Slave L., *Bedford* (Can.); Mackenzie R., *Richardson* (G).

This species is one of the most abundant in the Athabaska–Great Slave L. region. Its northern limit is yet unknown, though it undoubtedly extends far into the Mackenzie valley. The record in Fl. Bor.-Am. reads "Cumberland House. Bear Lake. . . ."

**Carex retrorsa** Schw. in Ann. Lyc. N. Y. **1:** 71 (1824); Raup in Jour. Arn. Arb. **17:** 220 (1936).

Grassy swale near Ft. Liard, *Nowosad* (Can.).

**Carex oligosperma** Michx. Fl. Bor.-Am. **2:** 174 (1803); Boott in Hooker, Fl. Bor.-Am. **2:** 220 (1839); Macoun, Cat. Can. Pl. Pt. 4: 168 (1888); Mackenzie in N. Am. Fl. **18:** 461 (1935); Raup in Jour. Arn. Arb. **17:** 220 (1936); Porsild in Sargentia **4:** 25 (1943).

A note on this species in Fl. Bor.-Am. says it extends from "Cumberland House to Bear Lake," and there is a specimen in Herb. G which bears the ambiguous label, "English River, Bear Lake, Norway House." Judging by later collections, the plant has a wide but spotty range in the north. It has been collected at Methye Portage (*Macoun*), and at several places on the south side of Lake Athabaska (Raup, l. c.). Porsild (l. c.) has recently reported a specimen from the Yellowknife R., so that eventually the old Fl. Bor.-Am. range may be substantiated.

## ARACEAE

**Calla palustris** L. Sp. Pl. 968 (1753); Raup in Jour. Arn. Arb. **17:** 221 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 385 (1942); Porsild in Sargentia **4:** 25 (1943).

Southwest and north shores of Great Slave L., *Howe 91988* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 9* (Can.); border of lowland slough on west bank of the Mackenzie R. near Simpson, *9895.*

Common in the Simpson locality, and also in the Athabaska–Great Slave Lake region. Collected by Porsild (l. c.) along the lower Mackenzie.

## LEMNACEAE

**Lemna trisulca** L. Sp. Pl. 970 (1753); Raup in Jour. Arn. Arb. **17:** 221 (1936); Hultén, Fl. Alaska & Yuk. Pt. 2: 386 (1942); Porsild in Sargentia **4:** 25 (1943).

This species is occasional in the Wood Buffalo Park and has been collected in the Mackenzie River delta by Porsild (l. c.). It has not been seen along the upper Mackenzie, though it is to be expected there.

JUNCACEAE

**Juncus bufonius** L. Sp. Pl. 328 (1753); Hooker, Fl. Bor.-Am. **2:** 191 (1839); Macoun in Cat. Can. Pl. Pt. 4: 60 (1888); Raup in Jour. Arn. Arb. **17:** 221 (1936); Hultén, Fl. Alaska & Yuk. Pt. 3: 422 (1943).

Damp slough along wood road just west of Simpson, *9885.*

Very common in this habitat, where it is a primary species on wet soil. It is also common on damp sand bars along the Mackenzie R. near Simpson. Found with maturing capsules late in August. Noted in Fl. Bor.-Am. as occurring "throughout Canada to Bear Lake."

**Juncus biglumis** L. Sp. Pl. 328 (1753); Hultén, Fl. Alaska & Yuk. Pt. 3: 421 (1943); Porsild in Nat. Mus. Can. Bull. **101:** 17 (1945).

Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11797* (Can.).

**Juncus albescens** (Lange) Fernald in Rhod. **26:** 202 (1924); Porsild in Nat. Mus. Can. Bull. **101:** 17 (1945).

*Juncus triglumis* L. var. *albescens* Lange, Conspect. Fl. Groenl. 123 (1880).

*Juncus triglumis* L., sensu Hultén, Fl. Alaska & Yuk. Pt. 3: 431 (1943), at least in part.

Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8263* (Can.).

Noted by Porsild (1. c.) also on the Plains of Abraham along the Canol Rd.

**Juncus triglumis** L. Sp. Pl. 328 (1753); Hultén, Fl. Alaska & Yuk. Pt. 3: 431 (1943), in part; Porsild in Nat. Mus. Can. Bull. **101:** 17 (1945).

Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11796* (Can.).

It should be noted that Hultén (1. c.) regards *J. albescens* as indistinguishable from *J. triglumis* in Alaska.

**Juncus Vaseyi** Engelm. in Trans. St. Louis Acad. **2:** 448 (1866).

Upland prairie west of Mackenzie R. near Simpson, *9925.*

Common, especially at or near the margins of the prairies, where it is a primary species in places. In fruit late in August. Not previously noted north of the Wood Buffalo Park (Raup in Jour. Arn. Arb. **17:** 222), although the Fl. Bor.-Am. record (p. 191) for *J. tenuis,* "Lake Huron, to Bear Lake. . .", may refer to it in part.

**Juncus balticus** Willd. in Mag. Naturf. Fr. Berlin **3:** 298 (1809); Hooker, Fl. Bor.-Am. **2:** 189 (1839).

Slave R., *Richardson* (G); east shore of Trout L., *C. O. Hage* (G); Mackenzie R., *Onion* (N); rocky sandy bank of Mackenzie R. opposite Simpson, *9944;* damp sand bar along Mackenzie R. near Simpson, *9886;* wet mossy sloughs and newly formed mud flats around the west end of Brintnell L., *9705, 9802.*

Common; in fruit at Brintnell L. early in August and at Simpson late in that month. I am referring this material to *J. balticus* in its broad sense, for I am at present unable to place it satisfactorily in any of the recognized segregates of that species. The Mackenzie valley plants probably could be placed in var. *littoralis* Engelm., but all of the material suggests a transition to some form of *J. arcticus* Willd. It all has short anthers (about 1 mm. long), which are about as long as the filaments.

**Juncus Drummondii** E. Mey. in Ledeb. Fl. Ross. **4:** 235 (1853); Hultén, Fl. Alaska & Yuk. Pt. 3: 425 (1943); Porsild in Nat. Mus. Can. Bull. **101:** 17 (1945).

Stony beach on shore of Brintnell L. at mouth of Frost Cr., *9671;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11218* (Can.).

Apparently rare at Brintnell L.; in flower early in August.

Our number *9671* contains a single plant which exhibits characters that suggest a varietal segregate of *J. Drummondii,* but with such scant material I do not think it wise to propose it. The plant has one flower in anthesis and another with a mature capsule. The flowers closely resemble those of *J. Drummondii,* though they are smaller. The valves of the capsule are dark brown and shining, retuse and mucronate like those of *J. Drummondii;* likewise the sepals, somewhat shorter than the capsule, are dark brown and striped with green. The inflorescences are single-flowered. The plant differs from *J. Drummondii* chiefly in having its leaf-sheaths with a distinct, though short blade instead of a bristle, and in having the auricles at the base of the bract more prominently expanded above. The lower sheaths have a distinct purplish tinge not seen in the species.

**Juncus filiformis** L. Sp. Pl. 326 (1753); Hooker, Fl. Bor.-Am. **2:** 190 (1839); Macoun, Cat. Can. Pl. Pt. 4: 55 (1888); Raup in Jour. Arn. Arb. **17:** 222 (1936); Hultén, Fl. Alaska & Yuk. Pt. 3: 427 (1943).

Noted in Fl. Bor.-Am. as occurring from "Saskatchewan to Bear Lake . . . ," but I have not seen specimens from the upper Mackenzie. It is occasional at Lake Athabaska and in the Wood Buffalo Park, and it has been collected in the central Yukon district (Hultén, l. c.).

**Juncus nodosus** L. Sp. Pl. 466 (1753); Macoun, Cat. Can. Pl. Pt. 4: 63 (1888); Raup in Jour. Arn. Arb. **17:** 223 (1936); Hultén, Fl. Alaska & Yuk. Pt. 3: 429 (1943).

*Juncus polycephalus* Michx. var. *tenuifolius* Hooker, Fl. Bor.-Am. **2:** 190 (1839).

Fort Smith, *Russell 28* (Can.); Mackenzie R., *Onion* (N); damp sand bars along the Mackenzie R. near Simpson, *9871, 9904;* rocky-sandy bank of Mackenzie R. opposite Simpson, *9945.*

Common; in fruit late in August. Noted in Fl. Bor.-Am. from "Canada, to Bear Lake."

**Juncus alpinus** Vill. var. **rariflorus** (Hartm.) Hartm. Scand. Fl. ed. 5: 244 (1849); Raup in Jour. Arn. Arb. **17:** 223 (1936). See Bot. Notiser **1932:** 313–372 (1932), and Rhod. **35:** 233–234 (1933).

*Juncus rariflorus* Hartm. Scand. Fl. ed. 1: 141 (1820).

*Juncus alpinus* Vill. ssp. *nodulosus* (Wahl.) Hultén, Fl. Alaska & Yuk. Pt. 3: 417 (1943).

*Juncus alpinus* Vill. var. *insignis* Fries; Macoun, Cat. Can. Pl. Pt. 4: 62 (1888).

*Juncus acutiflorus* sensu Hooker, Fl. Bor.-Am. **2:** 190 (1839), in part, non Ehrh.

*Juncus Richardsonianus* Schultes; Hooker, Fl. Bor.-Am. **2:** 191 (1839), in part.

Great Slave L., *Richardson* (G); Mackenzie R., *Onion* (N); same, *Meyer* (G); damp sand bar along the Mackenzie R. near Simpson, *9884.*

Very common at Simpson, where it is a primary species on sand bars. In fruit late in August. Noted in Fl. Bor.-Am. in the "Woody country to the Mackenzie River."

**Juncus castaneus** Smith, Fl. Brit. ed. 1, **1:** 383 (1800); Hooker, Fl. Bor.-Am. **2:** 192 (1838); Macoun, Cat. Can. Pl. Pt. 4: 58 (1888); Raup in Jour. Arn. Arb. **17:** 223 (1936); Hultén, Fl. Alaska & Yuk. Pt. 3: 423 (1943); Porsild in Nat. Mus. Can. Bull. **101:** 17 (1945).

Muskeg along wood road just west of the Mackenzie R. near Simpson, *9933;* Mackenzie R. between Wrigley and Blackwater R., *Crickmay 130* (Can.); between Blackwater R. and Norman, *Crickmay 160* (Can.); mud flats at mouth of glacial stream at west end of Brintnell L., *9264, 9703, 9718;* muskeg thickets on north shore of Brintnell L., *9361.*

Common to abundant; one of the primary species, with *Eriophorum Scheuchzeri,* colonizing the newly formed mud flats at the west end of Brintnell L. Collected in anthesis late in June, and with maturing capsules in July and August. Noted by Porsild (l. c.) at Little Keele R. along the Canol Rd.

**Luzula parviflora** (Ehrh.) Desv. in Jour. de Bot. **1**: 144 (1808); Hultén, Fl. Alaska & Yuk. Pt. 3: 440 (1943); Porsild in Nat. Mus. Can. Bull. **101**: 17 (1945).

*Juncus parviflorus* Ehrh. Beitr. **6**: 139 (1791).

Mackenzie R. between Blackwater R. and Norman, *Crickmay 16* (Can.).

Noted by Porsild (1. c.) as common in Macmillan Pass along the Canol Rd.

**Luzula Wahlenbergii** Rupr. Beitr. z. Pflanzenk. Russ. Reich. 2: 58 (1834); Hultén, Fl. Alaska & Yuk. Pt. 3: 443 (1943); Porsild in Nat. Mus. Can. Bull. **101**: 17 (1945).

Stony shore of Brintnell L. at Camp Pt., *9163;* damp grassy place in willow-birch scrub, upper valley of Frost Cr., alt. 4000′, *9508.*

Occasional on the shore of Brintnell L. but common in the willow-birch scrub. In flower late in June, and beginning to mature its capsules at the higher elevations about mid-July. Noted by Porsild (1. c.) as common in Macmillan Pass along the Canol Rd.

**Luzula spicata** (L.) DC. Fl. Franc. **3**: 161 (1805); Hultén, Fl. Alaska & Yuk. Pt. 3: 442 (1943).

*Juncus spicatus* L. Sp. Pl. 330 (1753).

Small stream on northeast slope of Red Mt., alt. 4500′, *9285;* shale slide rock, west slope of Terrace Mt., alt. 5000′, *9537;* shale slide rock, south slope of Red Mt., alt. 5000′–5900′, *9744;* shale cliffs at summit of Red Mt., alt. 5900′, north exposure, *9767.*

Common, especially at about 5000′. In anthesis late in June, and maturing capsules by mid-July.

**Luzula arcuata** (Wahl.) Wahl. Fl. Suec. **1**: 218 (1825); Hultén, Fl. Alaska & Yuk. Pt. 3: 433 (1943); Porsild in Nat. Mus. Can. Bull. **101**: 17 (1945).

*Juncus arcuatus* Wahl. Fl. Lapp. 87, *f. 4* (excl. *β*) (1812).

Stony beach at Camp Pt., Brintnell L., *9162;* rocky bed of small stream on east slope of Red Mt., alt. 4500′, *9268;* mossy bank of rocky stream bed, northeast slope of Red Mt., alt. 4300′, *9733;* shale slide rock on south slope of Red Mt., alt. 5800′, *9751;* east end of Macmillan Pass, Canol Rd., in alpine tundra, alt. 4600′, *Porsild 11884* (Can.).

Common in the wetter habitats noted at Brintnell L., but only occasional on the high slide rock. Plants collected June 20 at the lake shore (*9162*) were already maturing their capsules, while those at 4500′ on June 26 were still in anthesis.

**Luzula nivalis** (Laestad.) Beurl. in Bot. Notiser **1853**: 55 (1853); Hultén, Fl. Alaska & Yuk. Pt. 3: 438 (1943); Porsild in Nat. Mus. Can. Bull. **101**: 17 (1945).

*Luzula campestris* (L.) DC. var. *nivalis* Laestad. in Vet. Akad. Handl. (Stockh.), 333 (1822).

Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11798* (Can.).

**Luzula confusa** Lindb. in Bot. Notiser **1855**: 9 (1855); Hultén, Fl. Alaska & Yuk. Pt. 3: 435 (1943); Porsild in Nat. Mus. Can. Bull. **101**: 17 (1945).

Shale rock-slide, west slope of Terrace Mt., alt. 6000′, *9530;* dry shale slope, south side of Red Mt., alt. 5000′, *9748;* ledges of shale cliffs, summit of Red Mt., alt. 5900′, *9764, 9769;* Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8264, 8265* (Can.); Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11219* (Can.).

Occasional at Brintnell L.; found with maturing capsules in mid-July and early August.

**Luzula campestris** (L.) DC. var. **alpina** Gand. Agrostol. Helv. **2**: 247 (1811); Raup in Jour. Arn. Arb. **17**: 223 (1936).

Evidence for the presence of *L. campestris* in southwestern Mackenzie is very slender at present. I have seen but two specimens from the Mackenzie basin, both of which I have referred to var. *alpina.* One is from the eastern arm of

Great Slave L. (*Raup 424*) and the other is from Great Bear L. (*J. M. Bell,* Can.). The record in Fl. Bor.-Am. under *L. campestris,* "Woody and barren country," probably refers at least in part to this variety.

LILIACEAE

**Tofieldia palustris** Huds. Fl. Angl. ed. 2: 157 (1778); Hooker, Fl. Bor.-Am. **2:** 179 (1839); Raup in Jour. Arn. Arb. **17:** 224 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 17, 30 (1945).

*Tofieldia borealis* Wahl.; Macoun, Cat. Can. Pl. Pt. 4: 43 (1888).

Southwest and north shores of Great Slave L., *Howe 91987* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Bear Lake R., *Richardson* (G); mossy banks and muskeg thickets at west end of Brintnell L., *9243;* wooded lower slope of Colonel Mt., extending above timber line, *9625;* Lone Mt., *Wynne-Edwards 8441* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8269* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11855* (Can.).

Common in the Brintnell L. shore localities mentioned, but infrequent on the mountains north of the lake. In flower late in June, and with maturing fruit in the latter part of July. Noted by Porsild along the Canol Rd., also at Little Keele R., and the Plains of Abraham.

**Tofieldia coccinea** Richardson, Bot. App. Frankl. Journ. 736 (1823); Hultén, Fl. Alaska & Yuk. Pt. 3: 444 (1943); Porsild in Nat. Mus. Can. Bull. **101:** 17, 30 (1945).

*Tofieldia coccinea* Richardson var. *major* Hooker, Fl. Bor.-Am. **2:** 179 (1839); Macoun in Cat. Can. Pl. Pt. 4: 44 (1888).

Mackenzie R., *Richardson* (G); Liard R. between Nahanni Butte and Simpson, *Crickmay 14* (Can.); Lone Mt., *Wynne-Edwards 8440* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Porsild 11831* (Can.); same place, *Wynne-Edwards 8268* (Can.).

Also noted by Porsild in Macmillan Pass.

**Tofieldia glutinosa** (Michx.) Pers. Syn. **1:** 399 (1805); Hooker, Fl. Bor.-Am. **2:** 179 (1839); Macoun, Cat. Pl. Pt. 4: 44 (1888); Raup in Jour. Arn. Arb. **17:** 224 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 30 (1945).

*Narthecium glutinosum* Michx. Fl. Bor.-Am. **1:** 210 (1803).

"Cumberland House to Bear Lake," *Richardson* (G); Liard R., between Nahanni Butte and Simpson, *Crickmay 13* (Can.); north peak, Nahanni Mt., *Wynne-Edwards 8625* (Can.).

All of these plants appear to represent the eastern American *T. glutinosa* rather than the western *T. occidentalis.* See Raup in Contr. Arn. Arb. **6:** 137 (1934), and Hultén in Fl. Alaska & Yuk. Pt. 3: 446 (1943), for discussions of these species.

**Zygadenus elegans** Pursh, Fl. Am. Sept. **1:** 241 (1814); Macoun, Cat. Can. Pl. Pt. **4:** 52 (1888); Raup in Jour. Arn. Arb. **17:** 224 (1936); Hultén, Fl. Alaska & Yuk. 3: 449 (1943); Porsild in Nat. Mus. Can. Bull. **101:** 17, 30, 34 (1945). See Rhod. **37:** 256–258 (1935).

*Zygadenus chloranthus* Richardson; Hooker, Fl. Bor.-Am. **2:** 177 (1839).

Clewi R., Wood Buffalo Park, *Russell 7* (G); Resolution, *E. A. & A. E. Preble 162* (US); southwest and north shores of Great Slave L., *Howe 91985, 91986* (Can.); Windy Pt., Great Slave L., *Hume 102657* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Old Fort Rae, *Russell* (Can.); "Cumberland House to Bear Lake," *Richardson* (G); Liard R., between Nahanni Butte and Simpson, *Crickmay 15, 16* (Can.); Willow Lake R., 44 mi. above mouth, *Crickmay 12* (Can.); Saline R., above Norman, *Wynne-Edwards 8571* (Can.); north slope of Colonel Mt., in alpine meadows and subalpine scrub, *9424, 9660;* margin of slough in gravel plain near west end of Brintnell L., *9445;* Lone Mt., *Wynne-Edwards 8442* (Can.); Nahanni Mts., *Preble & Cary 53, 65* (US); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8266* (Can.).

Common at Brintnell L.; in flower early in July. Noted by Porsild along the Canol Rd. also at Little Keele R.

**Veratrum Eschscholtzii** Gray in Ann. Lyc. Nat. Hist. N. Y. **4**: 119 (1837); Hultén, Fl. Alaska & Yuk. Pt. 3: 451 (1943); Porsild in Nat. Mus. Can. Bull. **101**: 17 (1945).

Noted by Porsild at Macmillan Pass along the Canol Rd.

**Allium Schoenoprasum** L. var. **sibiricum** (L.) Hartm. Scand. Fl. ed. 4: 102 (1843); Raup in Jour. Arn. Arb. **17**: 224 (1936); Hultén, Fl. Alaska & Yuk. Pt. 3: 453 (1943).

*Allium sibiricum* L. Mant. 562 (1771).

*Allium Schoenoprasum* L. sensu Hooker, Fl. Bor.-Am. **2**: 185 (1839); Macoun, Cat. Can. Pl. Pt. 4: 35 (1888).

Northwest shore of Great Slave L., *Bedford* (Can.); "Carlton House to Slave Lake," *Richardson* (G); Mackenzie R. at junction with Bell R., *McConnell 27421* (Can.); Liard R., between Nahanni Butte and Simpson, *Crickmay 12* (Can.); rocky-sandy shore of Mackenzie R., opposite Simpson, *9963;* in silty soil near Mackenzie R. at Simpson, *Nowosad* (Can.); Mackenzie R., between Wrigley and Blackwater R., *Crickway 131* (Can.).

Common in the Simpson locality; in fruit in the last week of August. Noted in Fl. Bor.-Am. as occurring "Throughout the woody country to Bear Lake."

**Lloydia serotina** (L.) Rchb. Fl. Germ. Excurs. 102 (1830); Porsild in Sargentia **4**: 25 (1943); Hultén, Fl. Alaska & Yuk. Pt. 3: 456 (1943); Porsild in Nat. Mus. Can. Bull. **101**: 17 (1945).

*Bulbocodium serotinum* L. Sp. Pl. 294 (1753).

Liard R., between Nahanni Butte and Simpson, *Crickmay 11* (Can.); birch-willow thickets on north slope of Colonel Mt., alt. about 4000′, *9385;* Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11799* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8267* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11856* (Can.).

Occasional to common in the Colonel Mt. site which had only recently become free of snow; not seen elsewhere at Brintnell L. In flower the first week in July.

**Smilacina stellata** (L.) Desf. in Ann. Mus. Par. **9**: 52 (1807); Hooker, Fl. Bor.-Am. **2**: 176 (1839); Macoun, Cat. Can. Pl. Pt. 4: 30 (1888); Hultén, Fl. Alaska & Yuk. Pt. 3: 459 (1943).

*Convallaria stellata* L. Sp. Pl. 316 (1753).

Scrub timber on south slope of Red Mt., north of Brintnell L., *9224.*

Common in the above site, but not seen elsewhere in the Brintnell L. region. In flower late in June. Common in the Wood Buffalo Park (Raup in Jour. Arn. Arb. **17**: 224) and collected at Great Bear L. by Porsild (Sargentia **4**: 26). Our plants have unusually large flowers and a close, fine pubescence on the under sides of the leaves.

**Smilacina trifolia** (L.) Desf. in Ann. Mus. Par. **9**: 52 (1807); Hooker, Fl. Bor.-Am. **2**: 175 (1839); Macoun, Cat. Can. Pl. Pt. 4: 32 (1888); Raup in Jour. Arn. Arb. **17**: 224 (1936).

*Convallaria trifolia* L. Sp. Pl. 316 (1753).

Resolution, *Kennicott* (N); Liard R., between Nahanni Butte and Simpson, *Crickmay 17* (Can.); near large lake between southern extremities of Franklin Mts., *Crickmay 32* (Can.).

Noted in Fl. Bor.-Am. as occurring in "Swamps throughout Canada, to Bear Lake . . ."

**Maianthemum canadense** Desf. var. **interius** Fernald in Rhod. **16:** 211 (1914); Raup in Jour. Arn. Arb. **17:** 225 (1936).

*Maianthemum bifolia* sensu Hooker, Fl. Bor.-Am. **2:** 176 (1839), in part, non Roem.

*Maianthemum canadense* Desf. sensu Macoun, Cat. Can. Pl. Pt. 4: 32 (1888), in part.

Fort Smith, *Raup 436;* same, *Miss E. Taylor 27537* (Can.); same, *Seton & Preble 78569* (Can.); "Arctic America," *Richardson* (N); Liard R., between Nahanni Butte and Simpson, *Crickmay 18* (Can.); Simpson, *Miss E. Taylor* (N).

Noted in Fl. Bor.-Am. as extending northward to Great Bear L.

**Trillium cernuum** L. var. **macranthum** Eames & Wieg. in Rhod. **25:** 191 (1923).

*Trillium cernuum* L. sensu Hooker, Fl. Bor.-Am. **2:** 180 (1839), in part.

*Trillium erectum* var. *declinatum* sensu Macoun, Cat. Can. Pl. Pt. 4: 49 (1888), as to Mackenzie record, non Gray.

There is a specimen in the Gray Herbarium collected by Richardson and labeled "Mackenzie River." There is no indication as to where on the Mackenzie it came from, but presumably it is the basis of the northern range for *T. cernuum* given in Fl. Bor.-Am., ". . . from the Saskatchewan to Mackenzie River." It is the only evidence for the occurrence of any species of *Trillium* in the entire Mackenzie basin.

## IRIDACEAE

**Sisyrinchium angustifolium** Miller, Gard. Dict. ed. 8 (1768); Raup in Jour. Arn. Arb. **17:** 225 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 30, 33 (1945).

South shore of Mackenzie R., 10 mi. below Mills L., *Wynne-Edwards 8546* (Can.); Providence, *Preble & Cary 40* (US); Liard R., between Nahanni Butte and Simpson, *Crickmay 10* (Can.); dry southerly slope in old field at Simpson, *9124;* rocky-sandy shore of Mackenzie R. opposite Simpson, *9950;* Wrigley, *Miss E. Taylor 68* (Can.); Norman, *Dutilly 48* (G); "British America," *Richardson* (N); north peak, Nahanni Mt., *Wynne-Edwards 8443* (Can.).

Common in the Simpson area; in flower in mid-June; late flowers occasional in the last week in August, but most of the plants with mature capsules.

## ORCHIDACEAE

**Cypripedium passerinum** Richardson, Bot. App. Frankl. Journ. 34 (1823); Raup in Jour. Arn. Arb. **17:** 225 (1936); Hultén, Fl. Alaska & Yuk. Pt. 3: 469 (1943); Porsild in Nat. Mus. Can. Bull. **101:** 17, 30 (1945).

Lower Slave R., *Raup 469;* northwest shore of Great Slave L., *Bedford* (Can.); Liard R., between Nahanni Butte and Simpson, *Crickmay 20* (Can.); Wrigley, *Miss E. Taylor 11* (Can., N), *17* (G); Willow Lake R., 44 mi. above mouth, *Crickmay 17* (Can.); Bear Rock, Norman, *R. M. Anderson* (N); "British America," *Richardson* (N); willow-birch scrub at about 4000′ on north slope of Colonel Mt., *9386;* woods and thickets near west end of Brintnell L., *9447;* mossy woods near summit of Lone Mt., *Wynne-Edwards 8448* (Can.); north peak of Nahanni Mt., *Wynne-Edwards 8449* (Can.); Sekwi R., Canol Rd., mi. 174 E., alt. 3625′, *Porsild 11857* (Can.).

Common to abundant in the Brintnell L. localities; found flowering in the first half of July.

**Cypripedium parviflorum** Salisb. in Trans. Linn. Soc. **1:** 77, *pl. 2, f. 1* (1791); Porsild in Sargentia **4:** 26 (1943), in Nat. Mus. Can. Bull. **101:** 30 (1945).

Liard R., between Nahanni Butte and Simpson, *Crickmay 21* (Can.); Bear Rock, Norman, *A. E. & R. T. Porsild 3381* (Can.); north peak of Nahanni Mt., *Wynne-Edwards 8447* (Can.).

Apparently rare in the Mackenzie basin. In addition to the above stations Porsild has collected it along Bear R. and at Great Bear L. It has not yet been found in the Athabaska–Great Slave L. region.

**Cypripedium guttatum** Swartz in Vet. Akad. Handl. (Stockh.) **21:** 251 (1800); Hooker, Fl. Bor.-Am. **2:** 205 (1839); Macoun, Cat. Can. Pl. Pt. 4: 23 (1888); Raup in Jour. Arn. Arb. **17:** 226 (1936); Porsild in Sargentia **4:** 26 (1943); Hultén, Fl. Alaska & Yuk. Pt. 3: 468 (1943); Porsild in Nat. Mus. Can. Bull. **101:** 30 (1945).

Great Slave L., *R. Bell 23156* (Can.); Old Fort Rae, *Russell* (Can.); Liard R., between Nahanni Butte and Simpson, *Crickmay 19* (Can.); "River-between-two-mountains," just west of Franklin Mts., *Crickmay 10* (Can.); Norman, *Hume 103449* (Can.); mossy spruce woods near summit of Lone Mt., *Wynne-Edwards 8445* (Can.); north peak of Nahanni Mt., *Wynne-Edwards 8446* (Can.); Nahanni Mts., *Preble & Cary 77* (US).

Noted in Fl. Bor.-Am. as having been collected at "Fort Franklin, on the Mackenzie River."

**Cypripedium acaule** Ait. Hort. Kew. **3:** 303 (1789); Macoun, Cat. Can. Pl. Pt. 4: 22 (1888); Raup in Jour. Arn. Arb. **17:** 226 (1936).

*Cypripedium humile* Salisb.; Hooker, Fl. Bor.-Am. **2:** 204 (1839).

This species has not yet been collected in southwestern Mackenzie, but it has been found at Lake Athabaska and at Great Bear L. A Richardson specimen in Herb. G is labeled "Fort Franklin," and evidently is the basis for the range given in Fl. Bor.-Am., ". . . from Canada to Fort Franklin on the Mackenzie River."

**Orchis rotundifolia** Pursh, Fl. Am. Sept. **2:** 588 (1814); Raup in Jour. Arn. Arb. **17:** 226 (1936); Hultén, Fl. Alaska & Yuk. Pt. 3: 471 (1943); Porsild in Nat. Mus. Can. Bull. **101:** 30 (1945).

Windy Pt., Great Slave L., *Hume* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Old Fort Rae, *Russell* (Can.); Liard R., between Nahanni Butte and Simpson, *Crickmay 26* (Can.); Willow Lake R., 44 mi. above mouth, *Crickmay 14* (Can.); north peak of Nahanni Mt., *Wynne-Edwards 8450* (Can.); damp hollow in summit of Lone Mt., *Wynne-Edwards 8451* (Can.).

Common in the Athabaska–Great Slave L. region, and collected by Porsild (Sargentia **4:** 26) at Great Bear L. and on the lower Mackenzie.

**Habenaria viridis** (L.) R. Br. var. **bracteata** (Muhl.) Gray, Man. ed. 5: 500 (1867).

*Satyrium viride* L. Sp. Pl. 944 (1753).

*Orchis bracteata* Muhl. ex Willd. Sp. Pl. **4:** 34 (1805).

*Habenaria viridis* (L.) R. Br. var. *interjecta* Fernald; Raup in Jour. Arn. Arb. **17:** 226 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 31 (1945).

*Coeloglossum viride* (L.) Hartm. ssp. *bracteatum* (Muhl.) Hultén, Fl. Alaska & Yuk. Pt. 3: 472 (1943).

Liard R., between Nahanni Butte and Simpson, *Crickmay 23* (Can.); north peak of Nahanni Mt., *Wynne-Edwards 8455* (Can.).

**Habenaria hyperborea** (L.) R. Br. in Ait. Hort. Kew. ed. 2, **5:** 193 (1813); Macoun, Cat. Can. Pl. Pt. 4: 14 (1888); Raup in Jour. Arn. Arb. **17:** 226 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 30 (1945).

*Orchis hyperborea* L. Mant. 121 (1767).

*Platanthera hyperborea* (L.) Lindl., Hooker, Fl. Bor.-Am. **2:** 197 (1839); Hultén, Fl. Alaska & Yuk. Pt. 3: 479 (1943).

Lower Slave R., *Raup 446;* Great Slave L., *Onion, Kennicott & Hardisty* (N); northwest shore of Great Slave L., *Bedford* (Can.); damp place in prairie on upland west of Mackenzie R. near Simpson, *9891;* "River-between-two-mountains," just west of Franklin Mts., *Crickmay 4* (Can.); mossy bank on south shore of Brintnell L., *9332;* muskeg on north shore of Brintnell L., *9354;* damp woods and thickets at west end of Brintnell L., *9446;* north peak of Nahanni Mt., *Wynne-Edwards 9452* (Can.).

Common to abundant in the rich lowland woods about Brintnell L., where it flowers in late June and early July. Noted in Fl. Bor.-Am., "From the Saskatchewan to Fort Franklin."

**Habenaria obtusata** (Pursh) Richardson, Bot. App. Frankl. Journ. 750 (1823); Macoun, Cat. Can. Pl. Pt. 4: 16 (1888); Raup in Jour. Arn. Arb. **17:** 226 (1936); Porsild in Sargentia **4:** 26 (1943), in Nat. Mus. Can. Bull. **101:** 30 (1943).

*Orchis obtusata* Pursh, Fl. Am. Sept. **2:** 588 (1814).

*Platanthera obtusata* (Pursh) Lindl., Hooker, Fl. Bor.-Am. **2:** 196 (1839); Hultén, Fl. Alaska & Yuk. Pt. 3: 480 (1943).

Lower Slave R., *Raup 449;* Resolution, *Kennicott* (N); northwest shore of Great Slave L., *Bedford* (Can.); Windy Pt., Great Slave L., *Hume 102658* (Can.); southwest and north shores of Great Slave L., *Howe 91984* (Can.); Liard R., between Nahanni Butte and Simpson, *Crickmay 22* (Can.); damp mossy woods at Simpson, *9086, 9105;* Willow Lake R., 44 mi. above mouth, *Crickmay 20b* (Can.); muskeg thickets at west end of Brintnell L., *9239;* damp hollow, summit of Lone Mt., *Wynne-Edwards 8453* (Can.).

At Brintnell L. this species is occasional in the muskeg thickets at the west end of the lake and in the mossy open forest of *Picea mariana* on the north slope of Colonel Mt., where it reaches an altitude of 3200 feet or more. Found flowering in the latter half of June. Porsild (1943) says it is common throughout the Mackenzie country north to the tree line and "occasional or rare for a short distance beyond."

**Habenaria orbiculata** (Pursh) Torr. Fl. N. and Mid. U. S. 318 (1826); Porsild in Nat. Mus. Can. Bull. **101:** 30 (1945).

*Orchis orbiculata* Pursh, Fl. Am. Sept. **2:** 588 (1814).

*Platanthera orbiculata* (Pursh) Lindl., Hultén, Fl. Alaska & Yuk. Pt. 3: 482 (1943).

North peak of Nahanni Mt., in spruce woods, *Wynne-Edwards 8454* (Can.).

**Spiranthes Romanzoffiana** Cham. in Linnaea **3:** 32 (1828); Raup in Jour. Arn. Arb. **17:** 226 (1936); Hultén, Fl. Alaska & Yuk. Pt. 3: 485 (1943).

Little Buffalo R., *Russell 90* (G); Great Slave L., *R. Bell 23155* (Can.); same, *Onion, Kennicott & Hardisty* (N); Rae, *Russell* (Can.); Mackenzie R., between Wrigley and Blackwater R., *Crickmay 132* (Can.); near large lake between southern extremities of Franklin Mts., *Crickmay 31* (Can.).

The northern extent of *S. Romanzoffiana* in the Mackenzie country is not yet known. Northern specimens upon which the range, ". . . from Lake Huron . . . to Fort Franklin, on the Mackenzie River," in Fl. Bor.-Am. (2: 202) under *S. gracilis* is based may belong to this species.

**Goodyera repens** (L.) R. Br. var. **ophioides** Fernald in Rhod. **1:** 6 (1899); Raup in Jour. Arn. Arb. **17:** 227 (1936); Hultén, Fl. Alaska & Yuk. Pt. 3: 490 (1943); Porsild in Nat. Mus. Can. Bull. **101:** 31 (1945).

*Goodyera repens* (L.) R. Br. sensu Hooker, Fl. Bor.-Am. **2:** 203 (1839), in part; Porsild in Sargentia **4:** 26 (1943).

Bank of Mackenzie R. opposite Simpson, *Crickmay 38* (Can.); in damp lichen-moss mat in *Picea mariana* forest on north slope of Colonel Mt., alt. 2640′–4000′, *9657;* Lone Mt., *Wynne-Edwards 8456* (Can.).

Common in the Brintnell L. site noted above but not seen elsewhere in that district; just beginning to flower in late July. Leaves distinctly mottled. Hooker states in Fl. Bor.-Am. that *G. repens* extends ". . . from the Saskatchewan to Fort Franklin," and that its leaves are rarely reticulated. Material from the Athabaska–Great Slave L. region, however, has mottled leaves.

**Listera borealis** Morong in Bull. Torr. Bot. Cl. **20:** 31 (1893); Raup in Jour. Arn. Arb. **17:** 227 (1936); Hultén, Fl. Alaska & Yuk. Pt. 3: 486 (1943).

Fort Smith, *Miss E. Taylor* (N, Can., TYPE COLL.); same, *Raup 460;* Liard R., between Nahanni Butte and Simpson, *Crickmay 24* (Can.); Willow Lake R., 44 mi. above mouth, *Crickmay 20a* (Can.); muskeg thicket at west end of Brintnell L., *9240.*

Common at Brintnell L.; in flower late in June. Porsild (Sargentia **4**: 26) extends the range to Great Bear L. and the Mackenzie delta.

**Calypso bulbosa** (L.) Oakes in Thompson Hist. Vermont Pt. 1: 200 (1842); Raup in Jour. Arn. Arb. **17**: 227 (1936); Hultén, Fl. Alaska & Yuk. Pt. 3: 494 (1943); Porsild in Nat. Mus. Can. Bull. **101**: 31 (1945).

*Cypripedium bulbosum* L. Sp. Pl. 951 (1753).

*Calypso borealis* Salisb.; Hooker, Fl. Bor.-Am. **2**: 195 (1839); Macoun, Cat. Can. Pl. Pt. 4: 3 (1888).

Resolution, *Kennicott* (N); "Between Forts Simpson and Chipewyan," *Richardson* (Can.); Mackenzie R., *Kennicott* (N); Liard R., between Nahanni Butte and Simpson, *Crickmay 25* (Can.); Simpson, *Kennicott ?* (N); same, in rich woods, *9130;* north peak of Nahanni Mt., *Wynne-Edwards 8444* (Can.).

In flower about mid-June. According to Fl. Bor.-Am. it extends northward ". . . to Bear Lake River."

**Corallorrhiza trifida** Chat. Spec. Inaug. Corallorrhiza, 8 (1760); Raup in Jour. Arn. Arb. **17**: 227 (1936); Porsild in Sargentia **4**: 26 (1943); Hultén, Fl. Alaska & Yuk. Pt. 3: 492 (1943).

Fort Smith, *Miss E. Taylor* (G, Can.); Resolution, *Kennicott* (N); mossy woods on south shore of Brintnell L., *9355;* rich woods on lower north slope of Colonel Mt., *9425;* muskeg thickets near west end of Brintnell L., *9458.*

Occasional; in flower early in July. According to Porsild (l. c.) this species extends throughout the Mackenzie district northward to the tree line or a short distance beyond.

## SALICACEAE

**Populus tremuloides** Michx. Fl. Bor.-Am. **2**: 243 (1803); Hooker, Fl. Bor.-Am. **2**: 154 (1839); Macoun, Cat. Can. Pl. Pt. 3: 456 (1886); Raup in Jour. Arn. Arb. **17**: 227 (1936); Hultén, Fl. Alaska & Yuk. Pt. 3: 496 (1943).

Fort Smith, *Raup 489;* Little Buffalo R., *Russell 23* (G); Mackenzie R., *Kennicott* (N); spruce-birch forest on lower south slope of Red Mt., tree 40′ high, 5″ diam., *9313.*

Common to abundant throughout the Mackenzie basin forests. It owes much of its development to the fires which have burned the timber repeatedly. At Brintnell Lake it is most abundant on the slopes which gave evidence of having been burned over in comparatively recent time. It was observed up to about 4000′ on the mountain slopes. Aments had all fallen by mid-June. All the trembling aspens of this region appear to represent the doubtfully distinct var. *aurea,* the leaves of which turn yellow in autumn. This color is a striking and pleasing feature of the Mackenzie and Yukon landscapes in September.

**Populus Tacamahacca** Mill. Gard. Dict. ed. 8 (1788); Raup in Jour. Arn. Arb. **17**: 228 (1936); Hultén, Fl. Alaska & Yuk. Pt. 3: 495 (1943); Porsild in Nat. Mus. Can. Bull. **101**: 17 (1945).

*Populus balsamifera* sensu Hooker, Fl. Bor.-Am. **2**: 153 (1839); Macoun, Cat. Can. Pl. Pt. 3: 456 (1886); non L.

Fort Smith, *Raup 497;* Resolution, *J. W. Tyrrell 23132* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); north of the height of land between Great Slave and Great Bear Lakes, *Bedford* (Can.); Mackenzie R., *Onion* (N); Simpson, *Preble 304* (US); flood plain forest along Mackenzie R. near Simpson, *9068;* woods along Frost Cr., just back of camp at Brintnell L., *9315.*

Common to abundant on gravelly flats about the west end of Brintnell L., where it often occurs in nearly pure stands of open forest; also common along stony mountain streams at low elevations. In the old burn on the south slope of Red

Mt. it reaches an elevation of 3000′–4000′. At Simpson it is a primary part of the flood plain forest, but also occurs on the uplands. Fruits mature at Brintnell L. in late June, and at Simpson in the second week of June. Preble states that this tree extends along the entire length of the Mackenzie R., and a note in Fl. Bor.-Am. says that the Liard R. was so named ("Rivière aux Liards") because of the abundance of poplars on its banks. Porsild states that it was noted as common bordering creeks and rivers along the Canol Road.

**Salix lasiandra** Benth. Pl. Hartweg. 335 (1857); Raup in Jour. Arn. Arb. **17:** 228 (1936). See Jour. Arn. Arb. **1:** 14–20 (1919).

*Salix lucida* sensu Hooker, Fl. Bor.-Am. **2:** 148 (1839), in part; Macoun, Cat. Can. Pl. Pt. 3: 450 (1886), in part; non Willd.

Providence, *Dutilly* (G).

The Providence specimen appears to match material collected in the Athabaska Lake–Wood Buffalo Park region that I have referred to the typical form. Its northern limits are yet to be determined. Representatives of the *lasiandra* complex collected at Simpson I am proposing as the following variety.

**Salix lasiandra** Benth. var. **recomponens** var. nov.

A forma typica ramulis pubescentibus et foliis subtus viridibus differt.

Sandbar along Mackenzie R. near Simpson, shrubs 6′–8′ high, *9073,* m., *9076,* f. (TYPE).

Occasional in the Simpson area; collected with flowers and immature capsules June 11.

In the absence of a bloom on the lower surfaces of the leaves these plants suggest *S. lasiandra* var. *caudata* (Nutt.) Sudw., while the pubescence on the twigs relates them to var. *lancifolia* (And.) Bebb (See Schneider in Jour. Arn. Arb. **1:** 14–20, 1919, and Ball in Can. Field Nat. **40:** 145–150, 1926, for discussions of this group). In the shape of the leaves, which are lanceolate-acuminate rather than attenuate at the apex, they resemble the typical form or var. *lancifolia.* Variety *recomponens,* therefore, appears to be formed by a recombination of the characters by which the above three forms of the species are commonly distinguished. Ball (1. c.), following Heller (Muhlenb. **2:** 186, 1906), maintains *S. caudata* as a distinct species, but our plants suggest that it is only a phase in the *S. lasiandra* complex, equivalent in taxonomic value to other phases which are recognized only as varieties.

Hooker, in Fl. Bor.-Am., gives the range of *S. lucida* ". . . as far north as Fort Franklin on the Mackenzie River." This record is probably based upon all the *S. lucida*-like willows in the Mackenzie basin (*S. serissima, S. lasiandra* vars.).

**Salix interior** Rowlee var. **pedicellata** (Anders.) Ball in Can. Field Nat. **40:** 175 (1926); Raup in Jour. Arn. Arb. **17:** 229 (1936).

*Salix interior* Rowlee, sensu Ball in Can. Field Nat. **40:** 174 (1926); Hultén, Fl. Alaska & Yuk. Pt. 3: 504 (1943); at least in part.

*Salix longifolia* sensu Hooker, Fl. Bor.-Am. **2:** 149 (1839); Macoun, Cat. Can. Pl. Pt. 3: 450 (1886); non Muhl.

*Salix fluviatilis* sensu Preble in N. Am. Fauna **27:** 521 (1908), non Nutt.

Lower Slave R. near Grande Detour, *Harper 99019, 99025* (Can.); Slave R., *Kennicott* (N); between Forts Simpson and Chipewyan, *Richardson* (Can.); sand bar along Mackenzie R., near Simpson, shrubs 4′ high, *9069, 9070;* mouth of north Nahanni R., *Preble 362* (US).

Preble states that this species extends throughout the course of the Mackenzie R. It is common at Simpson, flowering in late May and early June.

Occasional specimens with the broader leaves of the typical form are seen in the lower Athabaska and Slave R. districts, and the Preble specimen from the North Nahanni R. has been so determined by Ball (1. c.). The broad-leaved form, however, is not well defined in the north, and I prefer to consider the whole population as representing var. *pedicellata*.

**Salix reticulata** L. Sp. Pl. 1018 (1753); Hooker, Fl. Bor.-Am. **2**: 151 (1839); Macoun, Cat. Can. Pl. Pt. 3: 454 (1886); Preble in N. Am. Fauna **27**: 523 (1908); Raup in Jour. Arn. Arb. **17**: 229 (1935); Hultén, Fl. Alaska & Yuk. Pt. 3: 505 (1943); Porsild in Nat. Mus. Can. Bull. **101**: 18, 31 (1945).

Liard R., between Nahanni Butte and Simpson, *Crickmay 30* (Can.); Smith Cr., 4 mi. above mouth, *Crickmay 26* (Can.); mossy muskeg thickets at the western end of Brintnell L., *9253*; east slope of Red Mt., alt. 4500′, *9301*; north peak of Nahanni Mt., *Wynne-Edwards 8462* (Can.); Lone Mt., *Wynne-Edwards 8463* (Can.); alpine bog at Bolstead Cr., alt. 5500′, Canol Rd., mi. 112 E., *Wynne-Edwards 8278, 8279* (Can.).

Occasional to common in mossy thickets and on rock-slides near the level of Brintnell L., and one of the commonest of the trailing willows at higher elevations. It becomes a primary species on the alpine north slopes of Colonel Mt., associated in the turf with *Dryas integrifolia, Cassiope tetragona, Carex scirpoidea, Festuca altaica, Vaccinium uliginosum*, and *Betula glandulosa*. Found flowering late in June. Noted by Porsild (1. c.) as common in Macmillan Pass along the Canol Rd.

**Salix polaris** Wahl. ssp. **pseudopolaris** (Flod.) Hultén, Fl. Alaska & Yuk. Pt. 3: 510 (1943).

*Salix pseudopolaris* Flod. in Vet. Akad. Ark. f. Bot. **20A**, No. 6: 8 (1926); Porsild in Nat. Mus. Can. Bull. **101**: 18 (1945).

Alpine slope at Bolstead Cr., Canol Rd., alt. 5500′, *Wynne-Edwards 8275, 8276, 8277* (Can.).

**Salix phlebophylla** Anders. Öfvers. Vet. Akad. Förhandl. (Stockh.) **15**: 131 (1858); Hultén, Fl. Alaska & Yuk. Pt. 3: 511 (1943); Porsild in Nat. Mus. Can. Bull. **101**: 18 (1945).

In limestone rubble, Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11800* (Can.); Bolstead Cr., Canol Rd., *Wynne-Edwards 8274* (Can.); Sekwi R., Canol Rd., mi. 174 E., alt. 3625′, *Porsild 11861* (Can.).

Porsild states that this species is common everywhere on limestone along the Canol Rd.

**Salix arctica** Pall. Fl. Ross. **1**, 2: 86 (1788); Raup in Jour. Arn. Arb. **17**: 230 (1936); Hultén, Fl. Alaska & Yuk. Pt. 3: 513 (1943); Porsild in Nat. Mus. Can. Bull. **101**: 18 (1945).

Alpine meadows and rock-slides, Colonel Mt., *9410*; trailing over rocks along small brook, west slope of Terrace Mt., alt. 5000′, *9504*; along small stream, east slope of Red Mt., alt. 4500′, *9279, 9280*; rocky east slopes of Red Mt., alt. 5000′–5800′, *9281, 9282, 9760*; Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11801* (Can.); Bolstead Cr., Canol Rd., mi. 112 E., alt. 4500′–5500′, *Wynne-Edwards 8272* (Can.).

Common to abundant on high alpine slopes throughout the Brintnell L. and Canol Rd. areas; the commonest of the trailing willows. In flower the last week of June, and with maturing capsules early in August.

**Salix crassijulis** Trautv. in Mem. Soc. Nat. Mosc. **2**: 308 (1832); Hultén, Fl. Alaska & Yuk. Pt. 3: 515 (1943).

Alpine meadows and rock-slides, north slope of Colonel Mt., *9410-A*.

Growing with *S. arctica*, but easily distinguished from the latter by its retuse leaves. Found with mature capsules Aug. 5. It is somewhat doubtful whether

*S. crassijulis* is specifically distinct from *S. arctica.* Hultén (1. c.) has an excellent discussion of this problem, and concludes that the whole *S. arctica* complex, including *S. crassijulis* and others, is one species with several geographic races. Apparently he maintains *S. crassijulis* as a species only tentatively until further studies of the group as a whole, with its intricate nomenclature, have been made. With this view I am inclined to agree.

**Salix arctophila** Cockerell ex Heller, Cat. N. Am. Pl. 89 (1910); Raup in Jour. Arn. Arb. **17:** 230 (1936); Porsild in Sargentia **4:** 27 (1943). See Schneider in Bot. Gaz. **66:** 140 (1918) and **67:** 57 (1919).

*Salix Uva-ursi* sensu Hooker, Fl. Bor.-Am. **2:** 152 (1839), in part?; Macoun, Cat. Can. Pl. Pt. 3: 455 (1886), in part?; non Pursh.

"Fort Franklin, Mackenzie River," *Richardson* (N) (no. *93,* H. B. & T.)

Porsild (1. c.) states that this species extends across the tundra country from Hudson Bay to the Mackenzie delta. I have collected it on the eastern arm of Great Slave L., however, well within the forested country, and the Richardson specimen also indicates that it is not limited to the tundra. It probably occurs in exposed situations in southwestern Mackenzie. Schneider (1. c.) suggests that the Hooker record for *S. Uva-ursi* in the northwest, "Woody country between lat. 54° and 64°," possibly belongs to *S. arctophila.*

**Salix brachycarpa** Nutt., N. Am. Sylva **1:** 69 (1843); Porsild in Nat. Mus. Can. Bull. **101:** 31 (1945).

Mackenzie R., between Blackwater R. and Norman, *Crickmay 162* (Can.); Lone Mt., *Wynne-Edwards 8459* (Can.).

*Salix brachycarpa* is occasional in the Wood Buffalo Park and common in the northern Rocky Mts., usually represented by var. *antimima* (Schn.) Raup. The Crickmay specimen cited above is a fragment, uncertainly determined, but the plant from Lone Mt. is clearly this species.

**Salix niphoclada** Rydb. in Bull. N. Y. Bot. Gard. **1:** 272 (1899); Preble in N. Am. Fauna **27:** 523 (1908); Porsild in Sargentia **4:** 28 (1943); Hultén, Fl. Alaska & Yuk. Pt. 3: 530 (1943).

The status of *S. niphoclada* in the flora of southwestern Mackenzie is doubtful. In fact, like so many other phases of the *S. glauca*-complex, its status as a species is in doubt. It was described from material collected along the Mackenzie about 30 miles north of the Arctic Circle, and the type (*Miss E. Taylor 60*) is in the National Herbarium of Canada. Porsild, who has made frequent comparisons of northern material with the type, states that the species "appears to be fairly common in the Palaeozoic country of the northwestern Mackenzie District." He has collected it at Great Bear L. and on Mt. Charles along the Bear R. Hultén has tentatively admitted the species to the flora of Alaska and Yukon, suggesting that it may be a hybrid complex. He gives it a range "from Alaska to Hudson Bay." Some specimens collected by Preble at Resolution and Fort Good Hope were originally determined as *S. niphoclada* by Rydberg, but most of them have been otherwise disposed of by later authors (Schneider in Bot. Gaz. **67:** 60–62, 1919; Ball in Univ. Calif. Publ. Bot. **17:** 416–417, 1934; Raup in Jour. Arn. Arb. **17:** 233, 1936). I have seen one of these specimens in Herb. US, Resolution, *Preble 193,* which appears to have stood the tests and remains to suggest that *S. niphoclada* extends up the Mackenzie to Great Slave L.

In terms of apparent major trends in the *S. glauca* group of willows, *S. niphoclada* seems to be intermediate between the typical *S. glauca*-like plants which are

so common in Mackenzie, the northern Rockies, and Alaska, and the short-catkined *S. brachycarpa* of the central Cordillera. Its catkins are not shortened as in *S. brachycarpa* but it has a habit of growth somewhat like the latter and has very short petioles similar to those of *S. brachycarpa.* It is probably but one of several partial segregates within the *S. glauca* group, similar in value to *S. glauca* vars. *acutifolia, Alliceae, Muricl, perstipula,* etc. It is probably best for the present to maintain the current concept of *S. niphoclada,* however, until more material from northern Mackenzie and Yukon is available. In this I agree with Hultén's treatment.

**Salix glauca** L. Sp. Pl. 1019 (1753); Raup in Jour. Arn. Arb. **17:** 232 (1936); Hultén, Fl. Alaska & Yuk. Pt. 3: 525 (1943).

*Salix glauca* L. var. *glabrescens* (Anders.) Schn. in Bot. Gaz. **66:** 329 (1918), in part.

*Salix glaucops* Anders. var. *glabrescens* Anders.; Preble in N. Am. Fauna **27:** 522 (1908), in part.

Northwest shore of Great Slave L. ?, *Bedford* (Can.); Mackenzie R., *Richardson* (Hb. Barr.); stony bank of the Mackenzie R. a few miles below Providence, shrubs 4′ high, *9976, 9978;* "Fort Franklin, Mackenzie R.," *Richardson* (N).

Occasional to common along the upper Mackenzie; found with maturing capsules Sept. 9. The leaves turn yellow on the upper surfaces after frost, while the lower surfaces remain quite glaucous. This material is similar to a large series of specimens from the Athabaska–Great Slave L. region that I have regarded as typical *S. glauca.* There is a great deal of variation in leaf form and pubescence, and in the form and size of the shrubs, but the whole series seems well within the range of variation of the Old World species as it is represented in our herbaria. It is of interest to find that Hultén now bears out the opinion, expressed long ago by Coville, that many Alaskan representatives of *S. glauca* are inseparable from those of northern Europe.

**Salix glauca** L. var. **acutifolia** (Anders.) Schneider in Bot. Gaz. **66:** 327 (1918); Raup in Jour. Arn. Arb. **17:** 232 (1936). See also Schneider in Bot. Gaz. **67:** 60 (1919), and Raup in Rhod. **33:** 241–244 (1931).

*Salix villosa* Hooker var. *acutifolia* Hooker, Fl. Bor.-Am. **2:** 144 (1838).

*Salix glauca* L. var. *villosa* Anders.; Macoun, Cat. Can. Pl. Pt. 3: 448 (1886).

*Salix Seemannii* Rydb.; Preble in N. Am. Fauna **27:** 522 (1908), in part.

*Salix desertorum* Richardson, Bot. App. Frankl. Jour. 753 (1823); Hooker, Fl. Bor.-Am. **2:** 151 (1839).

Mackenzie R., *Richardson* (N); "Fort Franklin, Mackenzie R.," *Richardson* (N, Hb. Barr.); Rae, *E. A. & A. E. Preble 138* (US); Providence, *Preble & Cary 42* (US); rocky slope near summit of Red Mt., alt. 5800′, *9759;* high alpine crevices and rock-slides on the north slope of Colonel Mt., alt. 5000′–6000′, *9409, 9421, 9627.*

Common in the Brintnell L. district, usually growing as a depressed shrub, sometimes with an elaborate root system penetrating the unstable slide rock; capsules maturing in August. The validity of var. *acutifolia,* like that of other *S. glauca* segregates, is open to question. I have preferred to keep it up, however, in order to give expression to a phase of the species which is very common in the Mackenzie basin. These plants have leaves somewhat smaller and more narrowly elliptic or lanceolate than the typical form. They are usually rather thinly hairy, with slightly and irregularly denticulate margins. In the Athabaska–Great Slave L. district var. *acutifolia* has its greatest development in the pre-Cambrian country, and in the Brintnell L. region of the Mackenzie Mts. it largely replaces the typical form. In Alaska Hultén has not recognized it as a valid

entity. He considers that most of the Alaska and Yukon specimens named var. *acutifolia* by Schneider are hybrids of *S. glauca* and *S. pseudomonticola.* The latter species has not been found in that part of the Mackenzie basin where var. *acutifolia* is most abundant, and in the Wood Buffalo Park, where *S. pseudomonticola* is occasionally seen, the more typical *S. glauca* is the commonest form in its group.

A few comments should be inserted here concerning *Salix desertorum.* Of all the *S. glauca* segregates in the Northwest this was the first to be described (Richardson, Bot. App. Frankl. Journ. 753, 1823), so that the name might have claims to priority. In spite of the fact that Richardson gave a fairly good diagnostic description of his plant, and that adequate co-type material is in American herbaria, the species has remained an enigma. Hultén has recently proposed that Andersson's designation of *S. desertorum* as a subspecies of *S. glauca* (see Anders. in Ofv. Vet. Akad. Förh. **15:** 129, 1858) be revived (Fl. Alaska & Yuk. 527). He looks upon this as "the arctic American *S. glauca* representative distributed from Alaska to Newfoundland." For plants having the lower leaf-surfaces densely villous he proposes a new variety *sericea* of ssp. *desertorum* (l. c.).

Hultén does not make clear just what forms he proposes to cover with ssp. *desertorum* in the vast subarctic region east of Yukon. After studying the willows of the Hudson Bay Region, Labrador Peninsula, and northern Newfoundland I concluded that *S. desertorum* as represented by our type material was not found there (Sargentia **4:** 102–110). All the eastern specimens that I have seen so labeled are better placed in *S. brachycarpa, S. cordifolia* vars., or in some of the other segregates of *S. glauca.* In the Mackenzie basin I have seen but one collection that I could match with Richardson's type. This is my no. *534,* from Taltheilei Narrows in the eastern arm of Great Slave Lake. In fact, an outstanding feature of the situation in that region is that, in spite of a great deal of collecting since Richardson's time, his plant has appeared so rarely.

In 1931 I published a brief discussion of the *S. glauca* forms in the Athabaska–Great Slave L. region (Rhod. **33:** 241–244, *pl. 218*) and suggested that Richardson's type of *S. desertorum* was only a dwarfed form of *S. glauca,* growing in an exposed rocky situation where it was subject to difficult soil and climatic conditions. My specimens from Great Slave L., which appear to match it so well, came from just such a spot. Hultén, having only my plate before him, suggested that the Slave L. plants represented his var. *sericea,* with the undersides of the leaves densely villous. This is not the case, however, for the leaves are only thinly villous to glabrescent beneath. In view of the fact that, in spite of much further collecting in the North, more authentic material of Richardson's plant has not turned up, I am inclined to hold to my earlier conclusion expressed above, and to consider *S. desertorum* of little or no taxonomic significance. There is some question as to whether it is identical with typical *S. glauca* or with var. *acutifolia.* I am placing it tentatively with the latter.

**Salix glauca** L. var. **Aliceae** Ball in Univ. Calif. Publ. Bot. **17:** 416, *pl. 74* (1934).

*Salix glauca* L. var. *acutifolia* (Hook.) Schn. f. *poliophylla* Schn. in Bot. Gaz. **67:** 61 (1919).

*Salix glauca* L. var. *poliophylla* (Schn.) Raup in Jour. Arn. Arb. **17:** 233 (1936).

Resolution, *E. A. & A. E. Preble 141* (US); same, *E. A. Preble 194* (US); Rae, *E. A. & A. E. Preble 139* (US, type of f. *poliophylla*).

I have not seen the type of Ball's var. *Aliceae*, but judging from his description and cited specimens it is the same as var. *poliophylla*. Ball mentions in his discussion the type number of the latter, stating that it would be "cited below," but in the citation of specimens the number does not appear. However, I assume from the context that Ball considered his var. *Aliceae* synonymous with *S. glauca* var. *acutifolia* f. *poliophylla* of Schneider.

**Salix glauca** L. var. **perstipula** var. nov. FIG. 13.

A varietatibus aliis *S. glaucae* stipulis conspicuis lineari-lanceolatis acuminatis differt; stipulis plerumque (interdum ad 5 annos) persistentibus, margine et ventro basim versus glandulosis, cito revolutis, saepe arcuato-patentibus, interdum quam petiolis longioribus.

Muskeg on south shore of Brintnell L., shrub 5′ high, *9321* (f.) (TYPE); along Frost Cr., just above Camp Pt., Brintnell L., shrub 6′ high, *9316;* open black spruce woods; north slope of Colonel Mt., alt. about 3000′, shrubs 5′–6′ high, *9632, 9633;* upper part of scrub timber, north slope of Colonel Mt., depressed shrub, *9412;* rock-slide, north slope of Colonel Mt., alt. 5000′, shrub 3′ high, *9630;* willow-birch scrub in upper valley of Frost Cr., alt. about 4000′, shrubs up to 6′ high, *9509;* south slope of Red Mt., alt. about 4000′, shrubs 6′ high, *9227, 9228;* northeast slope of Red Mt., alt. 5500′, shrub 1′ high, *9300;* Lone Mt., *Wynne-Edwards 8460* (Can.); east end of Macmillan Pass, *Porsild 11886* (Can.).

FIG. 13. *Salix glauca* var. *perstipula* Raup, var. nov.

Common to abundant about Brintnell L. It is probably the commonest willow in the area—certainly the most conspicuous—and it is a primary species in the open woods of the lower mountain slopes and in the willow-birch scrub in the upper valley of Frost Cr. Although found at higher levels, it appears to be replaced there largely by *S. glauca* var. *acutifolia*. Found with flowers and immature capsules late in June, and with bursting capsules about mid-August.

This willow has the habit of growth, glaucous leaves, foliolate peduncles, woolly capsules, and flavescent bracts of the bewildering complex which is commonly included in *S. glauca;* but it is at once distinguished from the other forms in this group by its conspicuous, lance-attenuate, persistent stipules. Within the *S. glauca* complex it appears nearest to var. *acutifolia* (Anders.) Schn. Schneider, in his rather carefully drawn description of this variety (Bot. Gaz. **66**: 327–329, 1918), states: "Stipulae ut videtur semper evolutae, in ramulis vegetis maximae, pl. m. lineari- ad semi-cordato-lanceolatae, rarius semi-ovato-rotundae, satis distincte glanduloso-denticulatae, ut folia pilosa, petiolo duplo breviores ad ⅓ vel fere duplo longiores, maximae surculorum ad 3 : 1 cm. magnae." Nothing is said here about the persistence of the stipules, but Schneider separated the entire *S. glauca* group in his key (Jour. Arn. Arb. **3**: 105, 1921) under a heading "Stipulae numquam persistentes, saepe nullae." After a careful examination of the numerous specimens of *S. glauca* and its relatives in the herbaria at Harvard, I have been unable to find any with persistent stipules of this nature. While Schneider included a linear-lanceolate form in his description, it is but rarely seen and does not show the acuminate character when dry. Polunin has recently designated a var. *stenolepis* (Nat. Mus. Can. Bull. **92**: 63, 1940) which is distinguished by these narrowly lanceolate stipules, but he says nothing about their being persistent.

It is of interest that at least three other willows in the Brintnell L. area are distinctive for their persistent stipules: *S. pulchra, S. Richardsonii,* and a new variety of *S. Barrattiana* to be described below. The character is not a common one among American willows and seems to be localized in the extreme northwestern part of the continent, perhaps illustrating a degree of convergence in the speciation of the region.

**Salix mackenzieana** Barr. apud Anders. in Öfr. Svensk. Vet. Akad. Förh. **15**: 125 (1858); Schneider in Jour. Arn. Arb. **2**: 190 (1921); Raup in Jour. Arn. Arb. **17**: 233 (1936).

*Salix cordata* Muhl. var. *mackenzieana* Hooker, Fl. Bor.-Am. **2**: 149 (1839); Macoun, Cat. Can. Pl. Pt. 3: 447 (1886).

Island in Slave R. below Grande Detour, *Harper 99026* (Can.); Great Slave L. ?, *Richardson* (G); Mackenzie R., *Richardson* (A, G, COTYPE); sand bar along Mackenzie R. near Simpson, shrubs about 5′ high, *9071, 9072, 9074, 9075.*

Occasional to common along the Mackenzie; found with maturing capsules June 11. One of the Simpson plants is notable for having its capsules strongly tinged with red (no. *9071*). More material and field observations are necessary before it can be determined whether this character deserves taxonomic recognition. In most descriptions the color of the capsules is not mentioned, though Ball states (in Coult. & Nels. New Man. Fl. Rky. Mts. 133) that they are greenish. On other specimens collected at Simpson, as well as elsewhere in the Mackenzie basin, the capsules are greenish; and those on the type material, of which there is a fragment in the Arnold Arboretum herbarium, do not show the red color. The type was collected along the Mackenzie River by Richardson in June, 1826. It is impossible to say whether the red would persist in very old specimens.

It is probable that at least a part of the material cited in Fl. Bor.-Am. under *S. rigida* (**2**: 149), "Between Fort Franklin and Cumberland House," belongs here, though it may be referable to *S. lutea.*

**Salix lutea** Nutt. N. Am. Sylva **1:** 63, *t. 19* (1843); Raup in Jour. Arn. Arb. **17:** 234 (1936).

Lower Slave R., *Raup 557.*

*Salix lutea* is common in the Athabaska–Peace delta and along the Slave R. Its northern extent on the upper Mackenzie is yet unknown.

**Salix myrtillifolia** Anders. in Öfv. Svensk. Vet. Akad. Förh. **15:** 132 (1858); Preble in N. Am. Faun. **27:** 521 (1908); Schneider in Jour. Arn. Arb. **2:** 193 (1921); Raup in Jour. Arn. Arb. **17:** 235 (1936); Hultén, Fl. Alaska & Yuk. Pt. 3: 537 (1943); Porsild in Nat. Mus. Can. Bull. **101:** 18, 31 (1945).

*Salix myrsinites* sensu Hooker, Fl. Bor.-Am. **2:** 151 (1839), non L.

*Salix novae-angliae* Anders. var. *pseudocordata* sensu Macoun, Cat. Can. Pl. Pt. 3: 452 (1886), in part, non Anders.

*Salix pseudo-myrsinites* sensu Preble in N. Am. Fauna **27:** 521 (1908), non Anders.

Resolution, *Preble 199, 200* (US); Providence, *Preble & Cary 43, 45* (US); "Fort Franklin, Mackenzie River," *Richardson* (G, N); Smith Cr., 4 mi. above mouth, *Crickmay 27* (Can.); muskeg thickets near west end of Brintnell L., trailing in wet moss, with branches sometimes *2'* high, *9254, 9255;* Nahanni Mts., *Preble & Cary 63* (US); same, *Preble 311* (US); summit of Lone Mt., *Wynne-Edwards 8461* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11860* (Can.).

Common in muskegs throughout the region; capsules maturing late in June. Our no. *9254* is of female specimens in which many of the aments are unusually elongated and loosely flowered. The fact that some individuals are quite typical suggests that the elongated aments are abnormalities.

Preble (see N. Am. Fauna **27:** 520) collected some specimens on the slopes of the Nahanni Mts. on June 6, 1904, which were determined by Rydberg as his *Salix padophylla* (Bull. Torr. Bot. Cl. **28:** 272, 499, 1901). I have not seen these specimens and consequently can do no more than suggest what they are. *Salix padophylla* was originally thought by Rydberg to be in the Sect. *Cordatae,* and he compared it with *S. mackenzieana* and *S. cordata.* Schneider related it rather to *S. adenophylla* and *S. commutata.* Ball has recently made it a variety of *S. pseudomonticola* in the Commutatae (Jour. Wash. Acad. Sci. **28:** 450, 1938). It is difficult to estimate Rydberg's determination of the Nahanni specimens, therefore, since it might have been in either of the above sections. *Salix monticola* is not known in the north, but *S. pseudomonticola* has been found in the Wood Buffalo Park and in Alaska. Preble's plants may have been the latter species.

**Salix Barclayi** Anders. in Öfv. Vet. Akad. Förh. **15:** 125 (1858); Hultén, Fl. Alaska & Yuk. Pt. 3: 533 (1943); Porsild in Nat. Mus. Can. Bull. **101:** 18 (1945).

Muskeg thickets at the western end of Brintnell L., shrubs *2'–4'* high, *9258, 9259, 9260;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11224* (Can.).

Noted as occasional at Brintnell L., but common in Macmillan Pass; found with maturing capsules June 23.

**Salix commutata** Bebb in Bot. Gaz. **13:** 110 (1888); Hultén, Fl. Alaska & Yuk. Pt. 3: 536 (1943).

Marshy muskeg thickets about the western end of Brintnell L., shrubs *2'–3'* high, *9256, 9257, 9499, 9500;* gravelly shore of Brintnell L. at Camp Pt., shrub *3'* high, *9307;* mud flats along stream near west end of Brintnell L., shrub *4'* high, *9692;* in willow scrub in upper valley of Frost Cr., alt. 4500', shrub *3'* high, *9503;* west slope of Terrace Mt., alt. 4800', depressed shrubs, *9501, 9505.*

Abundant on the marshy flats at the west end of the lake, where it is a primary species in the first thickets which form on the young deposits of mud brought in by the glacial stream. It is seen sporadically on gravelly lake shores,

and only occasionally at higher levels on the mountains. About the lake it was in flower late in June and began to mature its capsules about mid-July. Some of those collected at 4800′ were in flower about mid-July.

The capsules on nearly all of our plants are strongly tinged with red. When the fruit is well-formed this is a conspicuous feature, visible from a distance, although the color of the capsules is not mentioned in currently used manuals and monographs. In the original description of the species, however, Bebb states that they are "greenish or rufescent," and he mentions the rufescent character as one of the features of the species which relates it to *S. cordata.*

Bebb also described (1. c.) a var. *denudata,* having "young leaves smooth or nearly so," and this was kept up provisionally by Schneider (Jour. Arn. Arb. **1**: 160–162, 1920). It came from the same locality as the type (Eagle Creek Mts., Oregon, *Cusick*). Four of our numbers may be assigned to this smooth-leaved form: *9257, 9499, 9500, 9503;* and it will be noted that they occur with the typical plants or near them both at lake-level and higher in the mountains. These facts suggest that var. *denudata* is without habitat or geographic segregation, and may not be worthy of the rank of variety in the geographic sense.

**Salix Barrattiana** Hooker, Fl. Bor.-Am. **2:** 146, *t. 181* (1839); Hultén, Fl. Alaska & Yuk. Pt. 3: 542 (1943); Porsild in Nat. Mus. Can. Bull. **101:** 18 (1945)

Upper part of willow-birch scrub above timber line on north slope of Colonel Mt., alt. 4000′–5000′, depressed shrubs, *9370, 9371, 9422;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11223* (Can.).

Common on the north slope of Colonel Mt. at Brintnell L., but not seen elsewhere in that area. Porsild notes it as common in alpine passes and valley bottoms along the Canol Rd. It is a characteristic feature of alpine snow-fed watercourses. Collected with flowers and maturing capsules July 5.

**Salix Barrattiana** Hooker var. **marcescens** var. nov.

A forma typica ramulis dense hirsutis et stipulis linear- vel semicordato-lanceolatis persistentibus 1–2.5 cm. longis margine conspicue glanduloso-denticulatis differt.

Along small snow-fed stream on the north slope of Colonel Mt., alt. about 5000′, depressed shrub, *9374* (Type); Bolstead Cr., Canol Rd., mi. 111 E., alt. 5500′, *Wynne-Edwards 8273* (Can.); Sekwi R., Canol Rd., mi. 174 E., alt. 3625′, *Porsild 11841, 11858* (Can.).

Common at the Colonel Mt. site but not seen elsewhere in the Brintnell L. area; found with maturing capsules July 5; male plants not found.

The exact relationship of this form is not clear, although it appears to belong in the Section *Chrysantheae* as interpreted by Schneider (Jour. Arn. Arb. **1**: 211, 1920). Within this group it could be regarded as intermediate between *S. Barrattiana* and *S. Richardsonii,* two northwestern species that have long been regarded as distinct. It has persistent stipules that closely resemble in form, habit, and degree of persistence those of *S. Richardsonii,* but its leaves are narrower (elliptic to narrowly ovate) and persistently hairy or but tardily glabrate. In *S. Richardsonii* the leaves are soon glabrous and are commonly broadly ovate and sometimes almost rounded at the base. Furthermore the leaves of *S. Richardsonii* are usually glandular-dentate toward the base, while in our plants they are nearly or quite entire. Typical *S. Richardsonii* has glabrous capsules, while in our plants the capsules are permanently pubescent.

On the other hand, our material can be separated from *S. Barrattiana* only by its persistent stipules and the more densely hairy twigs. It has the character-

istic long, silky, pseudo-terminal aments of this species; and its leaves and habit of growth also place it here. It should be noted that the character of stipule persistence is not uncommon in this northwestern arctic and subarctic country. *Salix pulchra, S. Richardsonii,* and *S. glauca* var. *perstipula* (described above) are distinguished by it.

**Salix Richardsonii** Hooker, Fl. Bor.-Am. **2:** 147, *t. 182* (1839); Macoun, Cat. Can. Pl. Pt. 3: 454 (1886); Hultén, Fl. Alaska & Yuk. Pt. 3: 538 (1943); Porsild in Nat. Mus. Can. Bull. **101:** 18 (1945).

"Fort Franklin, Mackenzie River," *Richardson* (G, N); upper part of timber on the north slope of Colonel Mt., alt. 3200′–4000′, shrubs 4′–6′ high, *9391, 9624;* thickets along small snow-fed stream above timber line, north slope of Colonel Mt., alt. about 5000′, shrubs 4′–5′ high, *9372, 9373;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11227* (Can.).

A primary species among the shrubs in the open black spruce forest on the lower north slopes of Colonel Mt. It extends also some distance above timber line and is one of the principal species along snow-fed streams. Capsules mature in the timbered areas early in July, but they are found with flowers at higher levels at the same time. *Salix Richardsonii* was observed only once except on the north slope of Colonel Mt. This was at an elevation of about 3800′ on the south slope of Terrace Mt., where it was growing in a springy muskeg behind a small ridge. Porsild notes it also as common in a muskeg along the Canol Rd. at mi. 51 E.

**Salix alaxensis** (Anders.) Cov. in Proc. Wash. Acad. Sci. **2:** 280 (1900); Preble in N. Am. Fauna **27:** 521 (1908); Schneider in Jour. Arn. Arb. **1:** 223 (1920); Raup in Jour. Arn. Arb. **17:** 235 (1936); Hultén, Fl. Alaska & Yuk. Pt. 3: 539 (1943); Porsild in Nat. Mus. Can. Bull. **101:** 17 (1945).

*Salix speciosa* Hooker & Arn. sensu Hooker, Fl. Bor.-Am. **2:** 145 (1839); Macoun, Cat. Can. Pl. Pt. 3: 454 (1886); non Host.

*Salix speciosa* var. *alaxensis* Anders. in DC. Prodr. **16**[2]**:** 275 (1868).

Northwest shore of Great Slave L., *Bedford* (Can.); Norman, *Dutilly 2* (G); "Fort Franklin, Mackenzie River," *Richardson* (G); along small snow-fed stream on north slope of Colonel Mt., alt. about 5000′, shrubs up to 4′ high, *9375;* Lone Mt., *Wynne-Edwards 8457* (Can.); alpine bog, Bolstead Cr., Canol Rd., mi. 112 E., *Wynne-Edwards 8270* (Can.); Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11228* (Can.).

Common to abundant along watercourses on the mountain slopes and on stony or gravelly fans at the shore of Brintnell L. It is a primary species in this phase of the willow scrub above timber-line on Colonel Mt., and in the upper valley of Frost Cr. Capsules mature early in July. Such Mackenzie basin plants as I have seen represent the typical form or var. *longistylis,* rather than var. *obovalifolia* Ball in Jour. Wash. Acad. Sci. **28:** 443 (1938). The range of the latter variety appears to be eastward toward Hudson Bay (See Raup in Sargentia **4:** 115), although Ball cites one specimen (*Preble 290*) from Great Bear Lake.

**Salix alaxensis** (Anders.) Cov. var. **longistylis** (Rydb.) Schn. in Jour. Arn. Arb. **1:** 225 (1920); Hultén, Fl. Alaska & Yuk. Pt. 3: 541 (1943).

*Salix longistylis* Rydb. in Bull. N. Y. Bot. Gard. **2:** 163 (1901).

Stony shore of Brintnell L. near mouth of Frost Cr., shrub 15′ high, *9149.*

This variety apparently is only occasional in our region, and it was not observed above timber line. Capsules mature in the third week of June.

**Salix candida** Flügge apud Willd. Sp. Pl. **4:** 708 (1805); Hooker, Fl. Bor.-Am. **2:** 144 (1838); Macoun, Cat. Can. Pl. Pt. 3: 446 (1886); Schneider in Jour. Arn. Arb. **1:** 226 (1920); Raup in Jour. Arn. Arb. **17:** 237 (1936); Porsild in Sargentia **4:** 27 (1943).

Lobstick Cr., Little Buffalo R., *Russell 11* (Can.); Slave R., *Richardson* (Can.); muskeg thicket on the upland west of the Mackenzie R. near Simpson, *9909*.

This species appears to be widespread in the "woody country," as Hooker stated in Fl. Bor.-Am., but it is only occasional in occurrence. Porsild reports having seen it only once, at Great Bear L., during his extensive travels in northwestern Mackenzie. The Simpson specimen was collected late in August and is sterile.

**Salix Bebbiana** Sarg. in Garden & Forest **8**: 463 (1895); Preble in N. Am. Fauna **27**: 522 (1908); Schneider in Jour. Arn. Arb. **2**: 66 (1920); Raup in Jour. Arn. Arb. **17**: 237 (1936); Hultén, Fl. Alaska & Yuk. Pt. 3: 544 (1943).

*Salix rostrata* Richardson sensu Hooker, Fl. Bor.-Am. **2**: 147 (1839); Macoun, Cat. Can. Pl. Pt. 3: 453 (1886); non Thuill.

Fort Smith, *Raup 538, 2118;* same, *Seton & Preble 78311, 78312, 78309, 78310* (Can.); Slave R., *Kennicott* (N); Resolution, *Preble 195, 197* (US); same, *Dutilly 108* (G); Rae, *A. E. & E. A. Preble 137* (US); northwest shore of Great Slave L., *Bedford* (Can.); Providence, *Dutilly 81* (G); Simpson, *Preble 302-A, 306-A, 307* (US); damp lowland woods near Simpson, shrub 15′ high, *9080;* in scrub timber on south slope of Red Mt., Brintnell L., alt. about 3500′, shrub 10′ high, *9223;* Wrigley, *Preble & Cary 85* (US); "between Simpson and Chipewyan," *Richardson* (Can.); "between Cumberland House and Fort Franklin," *Richardson* (G, N); "Fort Franklin, Mackenzie River," *Richardson* (N).

*Salix Bebbiana* is one of the commonest willows in the Mackenzie basin. In the Simpson area it is common to abundant, forming a large part of the shrub growth in the upland woods west of the river. Preble states that it extends along the rivers to the lower Mackenzie. In the Brintnell Lake region, however, though common on the south slope of Red Mt., it was not seen elsewhere except as the following proposed variety, and then only occasionally. In flower at Brintnell L. in June.

Here, as in my studies of eastern arctic and subarctic willows (Sargentia **4**: 81–127), I am not attempting to separate the Mackenzie basin material into the commonly recognized varieties. Glabrous- or glabrescent-leaved forms are common throughout the range and have been called *S. perrostrata* by Rydb. (*S. Bebbiana* var. *perrostrata* Schn.). There are, however, so many intermediate forms that a segregation into recognizable entities is nearly if not entirely impossible.

According to Schneider (1. c.), Hooker's record for *S. fusca* L. in Fl. Bor.-Am. (**2**: 151) is referable to *S. Bebbiana*. It was based on specimens with male aments collected at "Fort Franklin on the Mackenzie River" by Richardson.

**Salix Bebbiana** Sarg. var. **depilis** var. nov.

A forma typica capsulis ramulis foliisque glabris differt.

Gravelly beach on shore of Brintnell L. at Camp Pt., shrub 5′ high, *9306*, f. (TYPE).

Occasional in this type of habitat; collected with immature capsules June 28. Some of the material collected by Miss Alice Eastwood at Dawson and elsewhere in Yukon, in 1914, appears to represent this glabrous form of the species. Her numbers *238*, *519*, and *566*, in the herbarium of the Arnold Arboretum, may be cited. Schneider noted these glabrous specimens in his discussion of *S. Bebbiana* (Jour. Arn. Arb. **2**: 66–72, 1920) but made no attempt to separate them taxonomically; nor did he mention the fact that their capsules were glabrous or nearly so. Variety *perrostrata* (Rydb.) Schn., described from material collected in the Black Hills (Bull. N. Y. Bot. Gard. **2**: 163, 1901), is distinguished by some students, and is separated from the species by its glabrescent leaves. Its cap-

sules, however, are hairy like those of the type. Our Brintnell L. plants are almost completely glabrous, even to the very young leaves and twigs. There are a few long ciliate hairs on the margins of the floral bracts. Two of the Eastwood numbers cited above (*238, 566*) are slightly hairy on very young twigs and petioles, but no. *519* closely resembles our plants.

**Salix pedicellaris** Pursh var. **hypoglauca** Fernald in Rhod. **11:** 161 (1909); Raup in Jour. Arn. Arb. **17:** 238 (1936).

*Salix pedicellaris* Pursh; sensu Hooker, Fl. Bor.-Am. **2:** 150 (1839), in part; Schneider in Jour. Arn. Arb. **2:** 81 (1920), in part.

*Salix myrtilloides* sensu Macoun, Cat. Can. Pl. Pt. 3: 451 (1886); Preble in N. Am. Fauna **27:** 521 (1908); non L.

"Fort Franklin, Mackenzie River," *Richardson* (N).

Noted in Fl. Bor.-Am. from "Saskatchewan to Fort Franklin . . . ," and by Preble at Norman. In the Athabaska–Great Slave L. region it is common on the south side of L. Athabaska but was not seen elsewhere.

**Salix petiolaris** Smith in Trans. Linn. Soc. London **6:** 122 (1802); Raup in Jour. Arn. Arb. **17:** 238 (1936).

Fort Smith, *Raup 568.*

*Salix petiolaris* is common in the Wood Buffalo Park, but has been collected in southwestern Mackenzie only at Fort Smith. It will almost certainly be found in the northern area of the Park, if not along the upper Mackenzie.

**Salix Scouleriana** Barratt var. **coetanea** Ball in Jour. Wash. Acad. Sci. 24: 73 (1934).

*Salix Scouleriana* Barratt, sensu Hultén, Fl. Alaska & Yuk. Pt. 3: 550 (1943); Porsild in Nat. Mus. Can. Bull. **101:** 18 (1945).

Stony shore of Brintnell L. and open spruce woods on Camp Pt., shrubs or small trees 15′–20′ high, *9146, 9234.*

Occasional or common on stony fans on the north side of Brintnell L., and extending up the warm south-facing slopes of Red and Terrace Mts. to about 4000′. Not observed south of the lake. Capsules mature in the latter part of June. On the lower mountain slopes it grows to tree size, with trunks as much as 6″ in diameter. Porsild saw it on a small tributary to Godlin R., along the Canol Rd., mi. 168 E., where it was growing to a height of 20′. The extent of the species east of the mountains is uncertain. Preble collected specimens of a willow at Simpson which Rydberg determined as *S. Nuttallii* Sarg., now regarded as a synonym of *S. Scouleriana.* I have not seen the Preble specimen, and did not find the species growing at Simpson when I was there in 1939.

The pubescence on the young leaves and twigs in our plants is rather distinctive in being silky and somewhat shining instead of more or less opaque as in typical *S. Scouleriana.* More material is required before this character can be evaluated, especially in a species complex that is notably variable in leaf form and pubescence.

**Salix pulchra** Cham. in Linnaea **6:** 543 (1831); Schneider in Jour. Arn. Arb. **1:** 70 (1919); Hultén, Fl. Alaska & Yuk. Pt. 3: 547 (1943); Porsild in Nat. Mus. Can. Bull. **101:** 18 (1945).

"Fort Franklin, Mackenzie River," *Richardson* (N, no. *64,* H. B. & T.); near summit of Red Mt., alt. 5800′, depressed shrub 1′ high, *9230;* northeast slope of Red Mt., alt. 5500′, shrub 1′ high, *9299;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11229* (Can.).

Occasional at high elevations on Red Mt., but not seen elsewhere in the Brintnell L. area; collected with flowers and immature capsules in the last week of

June. Schneider (1. c.) cites a doubtful specimen collected by Capt. Pullen from "Fort Simpson to Great Bear Lake."

**Salix planifolia** Pursh, Fl. Am. Sept. **2:** 611 (1814); Hooker, Fl. Bor.-Am. **2:** 150 (1839); Schneider in Jour. Arn. Arb. **1:** 75 (1919); Raup in Jour. Arn. Arb. **17:** 239 (1936).

*Salix chlorophylla* sensu Macoun, Cat. Can. Pl. Pt. 3: 446 (1886); Preble in N. Am. Fauna **27:** 522 (1908); non Anders.

Resolution, *E. A. & A. E. Preble 143* (US); about 15 mi. east of Moraine Pt., northwest shore of Great Slave L., *Bedford* (Can., doubtful fragment); Rae, *E. A. & A. E. Preble 136* (US); Simpson, *Preble 303-B, 305* (US); "Fort Franklin, Mackenzie River," *Richardson* (N); stony shore of Brintnell L. at Camp Pt., shrubs 6′ high, *9148, 9150.*

This species is common on the stony fans at Brintnell L., and also in the willow-birch scrub in the upper valley of Frost Cr. (alt. about 4000′). Preble states that it is also common at Simpson. At Brintnell L. the capsules were beginning to mature during the third week in June. Noted in Fl. Bor.-Am. on "Mackenzie River and Bear Lake." Schneider (1. c.) cites a Preble specimen (*322-A*) from Norman, but I have not seen it.

In my studies of the Athabaska–Great Slave L. flora I determined a few specimens from the Wood Buffalo Park as *S. Nelsonii* Ball. One of these (*Raup 514*) came from Fort Smith, which is just in the southeastern corner of the area treated here. I am doubtful if this form can be maintained as distinct from *S. planifolia* in our region. The latter is extremely common in the forested parts of the Athabaska country and the Wood Buffalo Park, where it inhabits slough margins and local river flood plains.

Our Mackenzie Mt. plants strongly suggest *S. pulchra* in general habit, and although most of the leaves have the characteristic elliptic-lanceolate, lanceolate, or obovate-oblong shapes of *S. planifolia,* a few are somewhat rhombic as in *S. pulchra.* The plants have no persistent stipules, however, and since this is a principal character by which *S. pulchra* is distinguished, it seems best to keep the material in *S. planifolia.* *Salix pulchra* occurs in the region but seems to be confined to high mountain slopes.

**Salix arbusculoides** Anders. in Vet. Akad. Handl. (Stockh.) **6:** 147, *t. 8, f. 81* (1867); Macoun, Cat. Can. Pl. Pt. 5: 358 (1890); Preble in N. Am. Fauna **27:** 522 (1908); Schneider in Jour. Arn. Arb. **2:** 84 (1920); Raup in Jour. Arn. Arb. **17:** 239 (1936); Porsild in Sargentia **4:** 27 (1943); Hultén, Fl. Alaska & Yuk. Pt. 3: 549 (1943); Porsild in Nat. Mus. Can. Bull. **101:** 18, 31 (1945).

*Salix acutifolia* sensu Hooker, Fl. Bor.-Am. **2:** 150 (1839), non Willd.

*Salix argyrocarpa* sensu Macoun, Cat. Can. Pl. Pt. 3: 445 (1886), non Anders.

Fort Smith, *Raup 2096;* lower Slave R., *Harper 99027* (Can.); Resolution, *Preble 201* (US); northwest shore of Great Slave L., *Bedford* (Can.); Lake Grant, *Preble 248* (US); Providence, *Dutilly 80* (G); damp woods near Simpson, shrub 15′ high, *9079;* river bluff at Simpson, shrub 6′ high, *9104;* Norman, *Dutilly* (G); spruce woods and thickets just back of Brintnell L. Camp, shrubs or small trees up to 20′ high, *9263, 9317;* Nahanni Mts., *Preble 317* (US); Lone Mt., *Wynne-Edwards 8458* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8271* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11859* (Can.).

Common; our Simpson specimens were maturing their capsules in mid-June, and those at Brintnell L. in late June and early July. This species forms tall slender trunks, up to 2″ in diameter, when it grows in spruce woods. At Brintnell L. it was not observed more than a hundred feet or so above lake-level.

## MYRICACEAE

**Myrica Gale** L. Sp. Pl. 1024 (1753); Hooker, Fl. Bor.-Am. **2**: 160 (1839); Macoun, Cat. Can. Pl. Pt. 3: 434 (1886); Raup in Jour. Arn. Arb. **17**: 240 (1936).

Clewi R., *Russell 51* (G); northwest shore of Great Slave L., *Bedford* (Can.); Mackenzie R., between Blackwater R. and Norman, *Crickmay 163* (Can.).

Preble (N. Am. Fauna **27**: 523) reported this species northward to Great Bear L., and it was noted in Fl. Bor.-Am. "Throughout Canada, and to Fort Norman on the Mackenzie River." Recently Porsild (Sargentia **4**: 28) reports that it is common at Great Bear L. but rare in the Mackenzie delta.

## BETULACEAE

**Betula papyrifera** Marsh. var. **commutata** (Regel) Fernald in Rhod. **47**: 312 (1945).

*Betula alba* ssp. *occidentalis* (Hook.) Regel, *β commutata* Regel in Bull. Soc. Nat. Mosc. **38**: 401 (1865).

*Betula papyrifera* Marsh. var. *occidentalis* Sarg.; Raup in Jour. Arn. Arb. **17**: 241 (1936); Porsild in Sargentia **4**: 29 (1943); non *B. occidentalis* Hooker.

*Betula papyrifera* Marsh. ssp. *occidentalis* Hultén, Fl. Alaska & Yuk. Pt. 4: 582 (1944), non *B. occidentalis* Hooker.

Liard R. between Nahanni Butte and Simpson, *Crickmay 32* (Can.); gravelly open woods along Frost Cr. near Brintnell L. Camp, tree 30′ high, 6″ diam., *9566;* woods on lower slope of Red Mt., just back of Camp Pt., trees 30′–40′ high, 4″–5″ diam., *9314, 9318;* mossy shale ledge in gorge below east end of Brintnell L., tree 30′ high, 2″ diam., *9589;* same, tree 10′ high, 1.5″ diam., *9578;* open spruce wood on rocky knoll near east end of Brintnell L., tree 30′ high, 4″ diam., *9587;* Bear Rock, near Norman, *Porsild* (Can.).

Common to abundant in the woods around Brintnell L. and on the lower mountain slopes. In some places it is a primary part of the forest. It is the commonest tree birch of the area, usually distinguished by its reddish brown bark and by the proportionately elongated middle lobes of the floral bracts. Its twigs are usually glabrous and but little resinous. Between it and var. *humilis,* however, there is a maze of intermediate forms. Some of them have the glandular twigs of the latter but have bark strongly tinged with reddish brown, even in large trees. Others have brown bark and moderately resinous twigs. Still others have dark bark and non-resinous twigs but have bracts that look like those of var. *humilis.* This is illustrated by no. *9578.* A somewhat greater divergence is illustrated by no. *9587,* which has its bark somewhat tinged with red and it twigs slightly resinous like some of the intermediates. Most of its leaves, however, are truncate or shallowly cordate at the base, while those of the other forms are usually broadly cuneate. Its bracts have the elongated terminal lobes as in var. *commutata,* but they also have elongated divergent lateral lobes. The seed and its wings, though immature at the time of collection, show a tendency to be cuneate at the base. This form may prove worthy of distinction, but the material at hand (consisting of 3 branchlets with but a single ament among them) is too scanty for further interpretation.

**Betula papyrifera** Marsh. var. **humilis** (Regel) Fernald & Raup in Rhod. **47**: 321 (1945).

*Betula alba* ssp. *papyrifera* var. *humilis* Regel in DC. Prodr. **16**: 166 (1868).

*Betula papyrifera* var. *neoalaskana* (Sarg.) Raup in Contr. Arn. Arb. **6**: 152 (1934), in Jour. Arn. Arb. **17**: 241 (1936); Porsild in Sargentia **4**: 29 (1943), in Nat. Mus. Can. Bull. **101**: 18 (1945).

*Betula papyracea* Ait.; Hooker, Fl. Bor.-Am. **2**: 155 (1839), in part.

*Betula papyrifera* sensu Macoun, Cat. Can. Pl. Pt. 3: 436 (1886), in part; Preble in N. Am. Fauna **27**: 523 (1908), in part.

*Betula resinifera* Britton; Hultén, Fl. Alaska & Yuk. Pt. 4: 583 (1944).

Lower Slave R., *Raup 604;* northwest shore of Great Slave L., *Bedford* (Can.); Mackenzie R., *Onion, Kennicott & Hardisty* (N); Liard R., between Nahanni Butte and Simpson, *Crickmay 29* (Can.); ? Simpson, *Onion* (N); lowland woods near Simpson, tree 20′ high, *9854;* shale ledge in gorge below east end of Brintnell L., small tree 6′ high, diam. 1″, *9591;* Twitya R. valley, Canol Rd., mi. 124 E., *Porsild 11838* (Can.).

This is the common white birch of the Mackenzie valley, but it is only rare or occasional in the Brintnell L. district (see note under *B. papyrifera* var. *commutata*). Porsild states that it is common along the Canol Rd. west of Norman Wells only to mi. 124, where it was last seen. Our no. *9591* has the characteristic resinous twigs of var. *humilis,* and the bark is white, even on young trees. Catkins mature in late summer. In Fl. Bor.-Am. the white birch is reported northward only to lat. 65°, but both Preble and Porsild give it a range in the Mackenzie basin extending throughout the wooded region.

It proved difficult, during the summer of 1939 at Brintnell L., to secure good specimens of the larger birches. Very few aments were produced, although the abundant bare axes of the preceding year's crop indicated that the scarcity was not of regular occurrence. It was necessary in some cases to cut down whole trees or large branches and search them carefully in order to find enough aments for specimens. Most of the trees were badly infested with a leaf-curling insect.

**Betula occidentalis** Hooker, Fl. Bor.-Am. **2**: 155 (1839); ? Macoun, Cat. Can. Pl. Pt. 3: 437 (1886). See Fernald in Rhod. **47**: 312–316 (1945).

*Betula microphylla* sensu Raup in Jour. Arn. Arb. **17**: 242 (1936); Porsild in Sargentia **4**: 29 (1943), in Nat. Mus. Can. Bull. **101**: 31 (1945); non Bunge.

Open spruce woods on rocky knoll near east end of Brintnell L., shrub 5′–6′ high, *9590;* north peak of Nahanni Mt., alt. 2700′, *Wynne-Edwards 8464* (Can.).

Common at the Brintnell L. station cited above, but observed in only one other place in the area, on a terrace at about 3700′ on the south slope of Terrace Mt. Collected with maturing fruit July 24. Occasional in the Athabaska–Great Slave L. region, and collected by Porsild at Great Bear L. and in the Mackenzie delta.

Hultén, in Fl. Alaska & Yuk. Pt. **4**: 575, considers that all Alaskan material that has been called *B. microphylla* or *B. fontinalis* Sarg. is probably composed of hybrids between *B. glandulosa* and *B. resinifera* (= *B. papyrifera* var. *humilis*). He suggests further that all Mackenzie and eastern plants of this category have had the same origin. *Betula occidentalis* in our region is a rather well-defined and easily recognizable form, and until some proof of its hybrid origin is forthcoming I believe it more useful to maintain it as a species.

**Betula pumila** L. var. **glandulifera** Regel in DC. Prod. **16**$^2$: 171 (1864); Raup in Jour. Arn. Arb. **17**: 242 (1936).

Fort Smith, *Dutilly 95* (G).

There are only two specimens of this species known to me from the Mackenzie basin. One is the Fort Smith plant cited above, and the other came from the Conibear (Moose) L. district of the Wood Buffalo Park (*Raup 2176*). It is probably occasional in the upper Mackenzie valley.

**Betula glandulosa** Michx. Fl. Bor.-Am. **2**: 180 (1803); Hooker, Fl. Bor.-Am. **2**: 156 (1839); Macoun, Cat. Can. Pl. Pt. 3: 437 (1886); Preble in N. Am. Fauna **27**: 524 (1908); Raup in Jour. Arn. Arb. **17**: 242 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 573 (1944); Porsild in Nat. Mus. Can. Bull. **101**: 18, 31 (1945).

Great Slave L., *R. Bell 23157* (Can.); between Forts Simpson and Chipewyan, *Richardson* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 31* (Can.); "Fort Franklin, Mackenzie R.," *Richardson* (G); muskeg along south shore of Brintnell L., shrub 3′ high, *9341;* open spruce woods on rocky knoll near east end of Brintnell L., shrub 4′ high,

*9585;* willow-birch scrub in upper valley of Frost Cr., alt. 4000′–4500′, shrubs up to 5′ high, *9510;* shale slides on west slope of Terrace Mt., alt. 6000′, depressed shrub, *9502;* Lone Mt., *Wynne-Edwards 8465* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., wet alpine bog, alt. 5500′, *Wynne-Edwards 8280* (Can.).

Common to abundant in the Brintnell L. area, forming thickets on lowland muskegs and watercourses, and extending to high alpine situations. It has its greatest development in a "zone" just above timber line, ranging in vertical width from a narrow band to 1000 feet. This zone is broadest on the southward- and westward-facing slopes of Red and Terrace Mts., and narrowest on the north slope of Colonel Mt. *Betula glandulosa* is a primary species in most of the zone, associated with willows and other shrubs. Found with maturing aments late in July at lake-level; alpine specimens of that period have very young aments. Preble's records for *B. nana* and *B. glandulosa,* ". . . practically throughout the Hudsonian zone," and "throughout the region . . . northward into the Barren Grounds," probably both belong here, and it is noted in Fl. Bor.-Am. from ". . . Lake Winipeg to Fort Franklin."

**Alnus crispa** (Ait.) Pursh, Fl. Am. Sept. **2**: 623 (1814); Raup in Jour. Arn. Arb. **17**: 243 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 586 (1944); Porsild in Nat. Mus. Can. Bull. **101**: 18 (1945).

*Betula crispa* Ait. Hort. Kew **3**: 339 (1789).

*Alnus viridis* sensu Hooker, Fl. Bor.-Am. **2**: 157 (1839), at least in part; Macoun, Cat. Can. Pl. Pt. 3: 438 (1886); non DC.

*Alnus alnobetula* Ehrh.; Preble in N. Am. Fauna **27**: 525 (1908).

"Between Forts Simpson and Chipewyan," *Richardson* (Can.); Willow Lake R. near its mouth, *Crickmay 36* (Can.); gravelly fans and shores near Brintnell L. camp, shrubs up to 8′ high, *9147, 9815.*

Common to abundant in the Brintnell L. area. It is a primary species in the open black spruce forest on the lower north slopes of Colonel Mt., and extends up to timber line or a little above on the mountains north of the lake. Here it is associated with *Betula glandulosa* and *Salix glauca* var. *perstipula* in dense timber line scrub. It is one of the commonest shrubs of gravel fans along the lake. Collected in flower late in June and with maturing cones Aug. 15. Noted by Preble ". . . throughout the region from the Saskatchewan northward to the tree limit"; and in Fl. Bor.-Am. ". . . throughout the woody and barren country . . ." Porsild states that along the Canol Rd. it was common as far west as the upper Godlin R., mi. 142 E.

**Alnus tenuifolia** Nutt. Sylva **1**: *32, t. 10* (1842).

*Alnus incana* sensu Hooker, Fl. Bor.-Am. **2**: 157 (1839), in part; Macoun, Cat. Can. Pl. Pt. 3: 438 (1886), in part; Preble in N. Am. Fauna **27**: 525 (1908); Raup in Jour. Arn. Arb. **17**: 243 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 590 (1944); non (L.) Moench.

Northwest shore of Great Slave L., *Bedford* (Can.); Willow Lake R. near its mouth, *Crickmay 35* (Can.); thickets on low ground about the western end of Brintnell L., shrub 10′ high, *9471.*

*Alnus tenuifolia* is an important component of the lowland flood plain woods along the Mackenzie at Simpson. At Brintnell L. it is abundant in the situation noted above, but was not seen elsewhere. Noted in Fl. Bor.-Am. as far north as Fort Franklin, and by Preble north to the Peel R.

Hultén considers the Alaskan material in the "*incana* group" to be identical with the European. Fernald (1. c.), however, has recently shown that the eastern plants are clearly not the European *A. incana,* and he has taken up the name *A.*

*rugosa* for the more northerly of them. Our plants, though not idential in all respects with *A. rugosa*, appear to be nearer that species than to typical *A. incana*. Pending further study, therefore, I have preferred to apply Nuttall's name, *A. tenuifolia*, to them.

URTICACEAE

**Urtica gracilis** Ait. Hort. Kew **3:** 341 (1789); Hooker, Fl. Bor.-Am. **2:** 141 (1838); Macoun, Cat. Can. Pl. Pt. 3: 430 (1886); Raup in Jour. Arn. Arb. **17:** 244 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 592 (1944). See Fernald in Rhod. **28:** 193 (1926).

Clewi R., *Russell 13* (G); northwest shore of Great Slave L., *Bedford* (Can.); Wrigley Harbor, Great Slave L., on gravelly shore, *9980*.

Common in the Wood Buffalo Park and probably northward into the Mackenzie valley. Collected with maturing fruit early in September. In Fl. Bor.-Am. it is said to extend ". . . throughout the woody country, generally, on the east of the Rocky Mountains, as far as Fort Franklin, on the Mackenzie River." Fernald has shown that it has an extensive range in the northern Cordillera as well.

SANTALACEAE

**Geocaulon lividum** (Richardson) Fernald in Rhod. **30:** 23 (1928); Raup in Jour. Arn. Arb. **17:** 244 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 593 (1944).

*Comandra livida* Richardson, Bot. App. Frankl. Journ. 734 (1823); Hooker, Fl. Bor.-Am. **2:** 139 (1838); Macoun, Cat. Can. Pl. Pt. 3: 423 (1886).

Fort Smith, *Raup 648;* southwest and north shores of Great Slave L., *Howe 91983* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); east shore of Trout L., *C. O. Hage* (G); Liard R. between Nahanni Butte and Simpson, *Crickmay 33* (Can.); damp woods near Simpson, *9100;* near Wrigley, *Miss E. Taylor 134* (Can.); Willow Lake R. near its mouth, *Crickmay 37* (Can.); Willow Lake R., 44 mi. above mouth, *Crickmay 16* (Can.); woods along shore of Brintnell L., *9302;* Nahanni Mts., *Preble & Cary 72* (US).

Abundant in low woods; collected in flower during middle and late June. Noted in Fl. Bor.-Am. northward "to lat. 69° on the Mackenzie River."

POLYGONACEAE

**Rumex mexicanus** Meissn. in DC. Prodr. **14:** 45 (1856); Raup in Jour. Arn. Arb, **17:** 245 (1936).

*Rumex salicifolius* sensu Hooker, Fl. Bor.-Am. **2:** 129 (1838), in part; Macoun, Cat. Can. Pl. Pt. 3: 416 (1886), in part; non Weinm.

*Rumex sibiricus* sensu Hultén, Fl. Alaska & Yuk. Pt. 4: 605 (1944), in part, non Hultén.

Northwest shore of Great Slave L., *Bedford* (Can.); stony shore of Great Slave L. at Wrigley Harbor, *9983;* open field near Simpson, *9838*.

Occasional to common in the Simpson district, where it was collected in fruit late in August. Noted in Fl. Bor.-Am. from "Lake Winnipeg, to Great Bear Lake and Mackenzie River."

*Rumex mexicanus* has been subdivided by Rechinger (Field Mus. Publ. Bot. **17:** 58), and the northern representatives referred to *R. triangulivalvis* (Danser) Rich. These northern plants are described as having smaller valves and nutlets (valves 3 mm., nutlets 2 mm.) than typical *R. mexicanus* (valves 4 mm., 2.5 mm.). Our plants, however, have the larger valves and nutlets of the latter. Hultén (l. c.) has recently suggested that at least a part of the Mackenzie basin material belongs to his *R. sibiricus* (Fl. Kamtch. **2:** 48, *f. 7*, 1928). Judging by his figure and description, however, this is not the case, for our plants have proportionately larger and more pointed valves.

The Wrigley Harbor plants are peculiar in having purplish valves which were maturing without the development of any nutlets. Occasional specimens in the Gray Herbarium collection show poorly developed or undeveloped nutlets, but whether the character is worthy of recognition is uncertain. Our specimens were collected on Sept. 9, after frosts had commenced, so that the growth of the nutlets may have been halted prematurely.

**Rumex maritimus** L. var. **fueginus** (Phil.) Dusén, Svenska Exp. till Magellansl. **3**: 194 (1900); Raup in Jour. Arn. Arb. **17**: 245 (1936). See Fernald in Rhod. **17**: 80 (1915).

*Rumex fueginus* Phil. in Ann. Univ. Chile **91**: 493 (1895); Hultén, Fl. Alaska & Yuk. Pt. 4: 603 (1944).

Little Buffalo R., *Russell 29* (G); northwest shore of Great Slave L., *Bedford* (Can.); damp sand bar along Mackenzie R. near Simpson, *9870;* rocky-sandy bank of Mackenzie R. opposite Simpson, *9937*.

Occasional to common in these habitats; collected in fruit the last of August. Not previously reported below Great Slave L.

**Rumex arcticus** Trautv. in Middend. Sib. Reise **1**: 29 (1856); Porsild in Nat. Mus. Can. Bull. **101**: 18 (1945).

Noted by Porsild as common in Macmillan Pass, Canol Rd., mi. 225 E.

**Oxyria digyna** (L.) Hill, Hort. Kew. 158 (1768); Hultén, Fl. Alaska & Yuk. Pt. 4: 607 (1944); Porsild in Nat. Mus. Can. Bull. **101**: 18 (1945).

*Rumex digynus* L. Sp. Pl. 337 (1753).

Damp springy ledges and gullies on north slope of Colonel Mt., alt. 3500′–5000′, *9381, 9656;* Bolstead Cr., Canol Rd., mi. 111 E., alpine peak, alt. 6000′–7000′, *Wynne-Edwards 8281* (Can.).

Apparently more common on the north-facing slope of Colonel Mt. than elsewhere in the Brintnell L. area, occurring both above and below timber line; collected in flower July 5, and with maturing fruit July 28.

**Polygonum aviculare** L. Sp. Pl. 362 (1753); Hooker, Fl. Bor.-Am. **2**: 132 (1838); Macoun, Cat. Can. Pl. Pt. 3: 407 (1886); Raup in Jour. Arn. Arb. **17**: 245 (1936).

*Polygonum buxiforme* Small, sensu Hultén, Fl. Alaska & Yuk. Pt. 4: 615 (1944), in part.

Fort Smith, *Raup 658;* northwest shore of Great Slave L., *Bedford* (Can.); damp sand bar along Mackenzie R. near Simpson, *9876;* along wood road just west of town of Simpson, *9878*.

Common in the Simpson area; collected with maturing fruit in the last week of August. These specimens are referred to *P. aviculare* provisionally, and using the name in its broad sense. It is not impossible that two entities are involved, one native and the other an introduced weed growing around the settlement. *Polygonum aviculare*, also considered in the broad sense, was noted by Hooker as occurring "throughout Canada, to lat. 65°. . ."

**Polygonum viviparum** L. Sp. Pl. 360 (1753); Hooker, Fl. Bor.-Am. **2**: 130 (1838); Macoun, Cat. Can. Pl. Pt. 3: 412 (1886); Raup in Jour. Arn. Arb. **17**: 245 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 620 (1944); Porsild in Nat. Mus. Can. Bull. **101**: 18, 31 (1945).

Windy Pt., Great Slave L., *Hume 102660* (Can.); Mackenzie R., *Onion* (N); Liard R. between Nahanni Butte and Simpson, *Crickmay 34* (Can.); Bear R., *Miss E. Taylor 124* (Can.); stony shore of Brintnell L. at Camp Pt., *9193;* alpine meadows and scrub on north slope of Colonel Mt., *9407;* along streams in upper valley of Frost Cr., alt. 4000′–5500′, *9525;* turfy east slope of Red Mt., alt. 5000′–5900′, *9736;* Lone Mt., *Wynne-Edwards 8466* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alpine slope, alt. 5000′, *Wynne-Edwards 8283* (Can.).

Common; collected in flower at Brintnell L. on June 20, and at the summit of Red Mt. on Aug. 7. Porsild notes that it is only rare or occasional in Macmillan Pass.

**Polygonum Bistorta** L. ssp. **plumosum** (Small) Hultén, Fl. Alaska & Yuk. Pt. 4: 613 (1944); Porsild in Nat. Mus. Can. Bull. **101:** 18 (1945).

*Polygonum plumosum* Small in Bull. N. Y. Bot. Gard. **2:** 166 (1901).

Bolstead Cr., Canol Rd., mi. 111 E., alpine slope, alt. 5500′, *Wynne-Edwards 8282* (Can.).

**Polygonum alpinum** All. var. **lapathifolium** Cham. & Schl. in Linnaea **3:** 38 (1828); Porsild in Nat. Mus. Can. Bull. **101:** 18 (1945).

*Polygonum alaskanum* (Small) Wight; Hultén, Fl. Alaska & Yuk. Pt. 4: 610 (1944).

Noted by Porsild as common in Macmillan Pass, along the Canol Rd. It grows on river bars.

**Polygonum lapathifolium** L. var. **salicifolium** Sibth. Fl. Oxon 129 (1794); Raup in Jour. Arn. Arb. **17:** 246 (1936). See Fernald in Rhod. **23:** 259 (1921).

*Polygonum Persicaria* L. var. *minus* Hooker, Fl. Bor.-Am. **2:** 132 (1838).

Damp sand bar along Mackenzie R. near Simpson, *9877.*

Common in this habitat, where it usually shows a decumbent habit of growth, the stems arching over from the base and trailing on the wet sand; collected with maturing achenes Aug. 22. Occasional in the Wood Buffalo Park district, and noted by Hooker from "Saskatchewan to Great Bear Lake." So far as I am aware this is the only persicarioid *Polygonum* in the Mackenzie basin.

**Polygonum natans** A. Eat. forma **Hartwrightii** (Gray) Stanford in Rhod. **27:** 160 (1925); Raup in Jour. Arn. Arb. **17:** 246 (1936).

*Polygonum Hartwrightii* Gray in Proc. Am. Acad. **8:** 294 (1870).

*Polygonum amphibium* sensu Hooker, Fl. Bor.-Am. **2:** 131 (1838), in part, non L.

Fort Smith, *Raup 663;* northwest shore of Great Slave L., *Bedford* (Can.); upland prairie west of Mackenzie R. near Simpson, *9920.*

Only sterile specimens were collected near Simpson, late in August; and only the terrestrial form was seen. *Polygonum natans* is common in the Wood Buffalo Park and probably also in the upper Mackenzie valley. Hooker noted only the aquatic form as extending northward to Great Slave Lake, but the terrestrial one is about equally common there.

## CHENOPODIACEAE

**Chenopodium capitatum** (L.) Asch. Fl. Brandenb. **1:** 572 (1864); Macoun, Cat. Can. Pl. Pt. 3: 400 (1886); Raup in Jour. Arn. Arb. **17:** 246 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 625 (1944).

*Blitum capitatum* L. Sp. Pl. 4 (1753); Hooker, Fl. Bor.-Am. **2:** 126 (1838).

Lower Slave R., *Raup 675;* Little Buffalo R., *Russell 35* (G); northwest shore of Great Slave L., *Bedford* (Can.); Mackenzie R., *Kennicott* (N); cultivated field on west bank of Mackenzie R. near Simpson, *9930;* Mackenzie R. between Wrigley and Blackwater R., *Crickmay 132* (Can.).

Occasional to common, chiefly in waste places and in disturbed soil; fruit mature in late August. In Fl. Bor.-Am. it was noted northward only as far as Great Slave L.

**Chenopodium album** L. Sp. Pl. 219 (1753); Hooker, Fl. Bor.-Am. **2:** 127 (1838); Macoun, Cat. Can. Pl. Pt. 3: 398 (1886); Raup in Jour. Arn. Arb. **17:** 247 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 624 (1944).

Stony bank of Mackenzie R. a few miles below Providence, *9979;* rocky-sandy bank of Mackenzie R. opposite Simpson, *9946.*

A common weed of settlements and disturbed soils; in fruit late in August and early in September. Noted in Fl. Bor.-Am. northward as far as Great Bear L.

**Chenopodium leptophyllum** Nutt. ex Moq. in DC. Prodr. **13**[2]: 71 (1849); Raup in Jour. Arn. Arb. **17**: 247 (1936).

This species has not been seen in southwestern Mackenzie, but it appears to have a wide though scattered range in the Mackenzie basin, and is to be expected in our region. I have collected it in a small prairie just west of L. Athabaska, and there is a Richardson specimen in Herb. G marked "Fort Franklin, Mackenzie R." The latter was probably included in *C. album* in Fl. Bor.-Am.

**Corispermum hyssopifolium** L. Sp. Pl. 4 (1753); Hooker, Fl. Bor.-Am. **2**: 125 (1838); Macoun, Cat. Can. Pl. Pt. 3: 403 (1886); Raup in Jour. Arn. Arb. **17**: 247 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 632 (1944).

Great Slave L., *Richardson* (G); windblown sand bars along the Mackenzie R. near Simpson *9868*.

Common at Simpson, forming mat-like growths, usually of individual plants; a primary species in this unstable habitat.

**Salicornia europaea** L. Sp. Pl. 3 (1753); Raup in Jour. Arn. Arb. **17**: 247 (1936).

*Salicornia herbacea* L.; Hultén, Fl. Alaska & Yuk. Pt. 4: 633 (1944).

Junction of Nyarling and Little Buffalo Rivers, *Russell 72* (G).

Common on the Salt Plains west of the Slave R.

## AMARANTHACEAE

**Amaranthus retroflexus** L. Sp. Pl. 991 (1753).

Weed in a cultivated field on the west bank of the Mackenzie R. near Simpson, *9928*.

Common in this situation; fruit mature in late August. So far as I am aware this species has not previously been reported in the Mackenzie basin except in the Peace R. agricultural districts.

## PORTULACACEAE

**Claytonia megarrhiza** (Gray) Parry ex Wats. Bibl. Ind. 118 (1878); Porsild in Nat. Mus. Can. Bull. **101**: 18 (1945).

*Claytonia arctica* Adams var. *megarrhiza* Gray in Am. Jour. Sci. II. **33**: 406 (1862).

Bolstead Cr., Canol Rd., mi. 111 E., alpine slopes of west wall, alt. 4500′–5500′, *Wynne-Edwards 8626* (Can.).

## CARYOPHYLLACEAE

**Stellaria calycantha** (Ledeb.) Bong. in Mém. Acad. Imp. Sci. St. Pétersb. Ser. 6, Math. 2: 127 (1833); Porsild in Sargentia **4**: 37 (1943); Hultén, Fl. Alaska & Yuk. Pt. 4: 648 (1944); Porsild in Nat. Mus. Can. Bull. **101**: 19 (1945). See Rhod. **42**: 254 (1940).

*Stellaria borealis* Bigel.; Hooker, Fl. Bor.-Am. **1**: 94 (1830); Macoun, Cat. Can. Pl. Pt. 1: 74 (1883); Raup in Jour. Arn. Arb. **17**: 248 (1936).

Northwest shore of Great Slave L., 12 mi. east of Moraine Pt., *Bedford* (Can.); Mackenzie R., *Onion* (N); Simpson, *Onion, Kennicott & Hardisty* (N); edge of cultivated field near Simpson, *9111;* thickets on stony shore of Brintnell L., *9151;* wet meadows on mud flats along glacial stream near west end of Brintnell L., *9693*.

Common; in flower at Simpson about mid-June, and from late June to early August at Brintnell L. Collected by Porsild in the lower Mackenzie country and at Great Bear L. Also noted by Porsild as common in Macmillan Pass, on the Canol Rd.

**Stellaria crassifolia** Ehrh. in Hannov. Mag. **8**: 116 (1784); Raup in Jour. Arn. Arb. **17**: 248 (1936); Porsild in Sargentia **4**: 37 (1943); Hultén, Fl. Alaska & Yuk. Pt. 4: 650 (1944).

This species has not been collected in our region, but it has been found in the Wood Buffalo Park and in western arctic Canada generally (see Porsild, l. c.).

**Stellaria longipes** Goldie in Edinb. Phil. Jour. **6**: 327 (1822); Hooker, Fl. Bor.-Am. **1**: 95 (1830); Macoun, Cat. Can. Pl. Pt. 1: 75 (1883); Raup in Jour. Arn. Arb. **17**: 248 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 656 (1944); Porsild in Nat. Mus. Can. Bull. **101**: 19 (1945).

Fort Smith, *Seton & Preble 78318* (Can.); same place, *Dutilly 94* (G); same place, *Raup 717;* same place, *Miss E. Taylor* (G, Can.); Lower Slave R., *Raup 710;* Resolution, *Kennicott* (N); Hay River, *Hume 102661* (Can.); southwest and north shores of Great Slave L., *Howe 91981* (Can.); Mackenzie R., *Onion* (N); edge of cultivated field at Simpson, *9110;* "Cumberland House to Bear Lake," *Richardson* (G).

The Simpson specimens represent the glaucous form of the plant, which sometimes goes by the name of var. *laeta.* It is entirely replaced in the Brintnell L. area by the following variety. *Stellaria longipes* is noted in Fl. Bor.-Am. ". . . to the Mackenzie River and Bear Lake." It is occasional at Simpson, and in flower about mid-June.

**Stellaria longipes** Goldie var. **Edwardsii** (R. Br.) Wats. Bibl. Ind. 113 (1878).

*Stellaria Edwardsii* R. Br. App. Parry's 1st Voy. 271 (1824).

? *Stellaria laeta* Richardson, sensu Hultén, Fl. Alaska & Yuk. Pt. 4: 654 (1944).

Liard R. between Nahanni Butte and Simpson, *Crickmay 36, 37* (Can.); Mackenzie R. between Blackwater R. and Norman, *Crickmay 166* (Can.); "Fort Franklin, Mackenzie R.," *Coll. ?* (N); stony shore of Brintnell L., *9158;* mossy bank of small stream at Camp Pt., Brintnell L., *9191;* rock-slide along south shore of Brintnell L., *9349;* high alpine slide rock, north slope of Colonel Mt., *9413;* shale cliffs in gorge, north slope of Colonel Mt., alt. 3500′, *9834*; alpine meadows on south slope of Red Mt., alt. about 5000′, *9206;* Bolstead Cr., Canol Rd., mi. 111 E., alpine slopes, *Wynne-Edwards 8296, 8297* (Can.).

Occasional to common at Brintnell L., and noted as occasional or rare by Porsild in Macmillan Pass; most frequent on rock-slides of north-facing slopes. In flower in late June and early July.

Hultén, in Fl. Alaska & Yuk. Pt. 4, has preferred to recognize two separate species in the *S. longipes* complex: *S. laeta* Richardson and *S. longipes* Goldie. From his discussion I presume that his *S. laeta* is the small, glaucous, 1- to few-flowered form that I have called *S. longipes* var. *Edwardsii.* Our plants have comparatively broad, very glaucous leaves, and few flowers. They appear to match the descriptions and plate of *S. Edwardsii* of Hooker (Fl. Bor.-Am. **1**: 96, *t. 31*) and Richardson (Bot. App. Frankl. Journ. 738) better than those of *S. laeta* except for the pubescence of the sepals. Hultén has stressed this character, using it as diagnostic in this case. In our plants, however, the pubescence on the sepals is quite variable as to presence and quantity. Plants in the same colony will vary from sepals pubescent to quite glabrous. My personal experience with plants of the *S. longipes* group strongly suggests that entities found in it are hardly worthy of specific rank. Their geographic segregation, however, suggests that they should be considered as something more than forms (cf. Polunin in Nat. Mus. Can. Bull. **92**: 192, 1940).

**Stellaria longifolia** Muhl. in Willd. Enum. Pl. Hort. Bot. Berol. 479 (1806); Hooker, Fl. Bor.-Am. **1**: 94 (1830); Macoun, Cat. Can. Pl. Pt. 1: 74 (1883); Raup in Jour. Arn. Arb. **17**: 249 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 655 (1944).

Fort Smith, *Raup 718, 723;* edge of cultivated field at Simpson, *9109;* Norman, *Coll.?* (N).

Occasional in the upper Mackenzie valley; in flower about mid-June. Noted in Fl. Bor.-Am. in the "Woody country from lat. 54° to 64°."

**Stellaria media** (L.) Cyrill, Char. Comm. 36 (1784); Hultén, Fl. Alaska & Yuk. Pt. 4: 657 (1944).

*Alsine media* L. Sp. Pl. 272 (1753).

Damp thickets in a slough near Simpson, *9842.*

Common in this situation; capsules maturing late in August. Not previously noted in the Mackenzie basin north of L. Athabaska (Raup in Jour. Arn. Arb. **17**: 249).

**Cerastium Beeringianum** Cham. & Schl. in Linnaea **1**: 62 (1826); Raup in Jour. Arn. Arb. **17**: 249 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 664 (1944); Porsild in Nat. Mus. Can. Bull. **101**: 19 (1945). See Fernald & Wiegand in Rhod. **22**: 172 (1920).

Near Fort Smith, *Raup 694;* gravelly alder thickets on shore of Brintnell L. at Camp Pt., *9262;* dry gravelly watercourse at base of granite mountain west of Brintnell L., *9480;* mossy banks and shale slide rock in gorge on north slope of Colonel Mt., alt. 3200′–3500′, *9825;* Bolstead Cr., Canol Rd., high peaks, alt. 5500′, *Wynne-Edwards 8295* (Can.).

Common in the Brintnell L. habitats noted, but not observed elsewhere in that area; in flower late in June, and collected with both flowers and mature fruit about mid-August. Our no. *9480* appears to be intermediate between the typical species and var. *grandiflorum* (Fenzl) Hultén (see Hultén, l. c. and Fl. Aleut. Isles. 165–166). It has the large petals of the variety, but the glandular-hairy stems of the species.

**Cerastium arvense** L. Sp. Pl. 438 (1753); Raup in Jour. Arn. Arb. **17**: 250 (1936); Porsild in Sargentia **4**: 31 (1943); Hultén, Fl. Alaska & Yuk. Pt. 4: 663 (1944). See Fernald & Wiegand in Rhod. **22**: 178 (1920).

This species has not yet been collected in southwestern Mackenzie. It is to be expected, however, for it is common in the Wood Buffalo Park and has been collected by Porsild at Great Bear L. and in the Mackenzie delta.

**Sagina nodosa** (L.) Fenzl, Verbreit, Alsin. 18 (1833); Macoun, Cat. Can. Pl. Pt. 1: 79 (1883); Raup in Jour. Arn. Arb. **17**: 250 (1936); Porsild in Sargentia **4**: 31 (1943), in Nat. Mus. Can. Bull. **101**: 33 (1945).

*Spergula nodosa* L. Sp. Pl. 440 (1753); Hooker, Fl. Bor.-Am. **1**: 93 (1830).

South bank of Mackenzie R., 10 mi. below Mills L., *Wynne-Edwards 8547* (Can.); bank of Mackenzie R. opposite Simpson, *Crickmay 39* (Can.).

This species has also been collected in the Athabaska–Great Slave L. region and at Great Bear L. It is noted in Fl. Bor.-Am. as occuring from "Upper Canada, to the shores of the Arctic Sea, eastward of the Mackenzie River."

**Sagina Linnaei** Presl, Rel. Haenk. **2**: 14 (1831); Hultén, Fl. Alaska & Yuk. Pt. 4: 672 (1944).

Stony shore of Brintnell L. at Camp Pt., *9159.*

Apparently rare in this district, and observed only in the single spot cited above; found with flowers and immature capsules June 21.

**Arenaria lateriflora** L. Sp. Pl. 423 (1753); Hooker, Fl. Bor.-Am. **1**: 102 (1830); Macoun, Cat. Can. Pl. Pt. 1: 73 (1883); Raup in Jour. Arn. Arb. **17**: 250 (1936).

*Mochringia lateriflora* (L.) Fenzl; Hultén, Fl. Alaska & Yuk. Pt. 4: 689 (1944).

Fort Smith, *Raup 683;* Resolution, *Miss E. Taylor 51* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); near Rae, *Russell* (Can.); Mackenzie R., *Onion* (N); Providence, *Preble & Cary 28* (US); upper part of timber on south slope of Red Mt., *9205;* muskeg thickets near west end of Brintnell L., *9436.*

Common; in flower during late June and the first half of July. Hooker did not record this plant north of lat. 60°.

**Arenaria nardifolia** Ledeb. Fl. Alt. **2:** 166 (1830); Porsild in Sargentia **4:** 30 (1943).

Mackenzie R. between Blackwater R. and Norman, *Crickmay 165* (Can.).

Porsild has collected this species also at Great Bear L., on the arctic coast, and in the Mackenzie delta.

Hultén apparently considers that the American representative of this group is *A. capillaris* Poir. (Encycl. Méth. **6:** 380, 1804), which he says is distinguished from *A. nardifolia* by the subulate apices of the leaves of its sterile shoots.

**Arenaria dawsonensis** Britton in Bull. N. Y. Bot. Gard. **2:** 169 (1901); Raup in Jour. Arn. Arb. **17:** 250 (1936); Porsild in Sargentia **4:** 30 (1943), in Nat. Mus. Can. Bull. **101:** 31 (1945).

*Minuartia stricta* sensu Hultén, Fl. Alaska & Yuk. Pt. 4: 686 (1944), in part, non Hiern.?

*Arenaria stricta* sensu Hooker, Fl. Bor.-Am. **1:** 99 (1830), in part, non Michx.

*Arenaria Michauxii* sensu Macoun, Cat. Can. Pl. Pt. 1: 72 (1883), in part, non Hooker.

Stony beach on Brintnell L. at Camp Pt., *9157;* dry sand plain near west end of Brintnell L., *9452;* near summit of Lone Mt., *Wynne-Edwards 8467* (Can.).

Occasional; in flower in late June and early July. This species is occasional to common in the Athabaska–Great Slave L. region, and has been collected at Great Bear L. by Porsild. Hultén (1. c.) has reduced the Alaskan and Yukon *A. dawsonensis* to *Minuartia stricta* of the Old World, and suggests that our Mackenzie plants as well as those in northeastern America also represent that species. He does not, however, present a detailed comparison of American and Eurasian material, and until this is possible it seems best to maintain *A. dawsonensis* as an American species.

**Arenaria verna** L. var. **pubescens** (Cham. & Schl.) Fernald in Rhod. **21:** 21 (1919); Raup in Jour. Arn. Arb. **17:** 250 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 31 (1945).

*Arenaria hirta* var. *pubescens* Cham. & Schl. in Linnaea **1:** 56 (1826).

*Arenaria propinqua* Richardson; Hooker, Fl. Bor.-Am. **1:** 99 (1830).

*Arenaria verna* L. var. *hirta* (Wormskj.) Wats.; Macoun, Cat. Can. Pl. Pt. 1: 71 (1883).

*Minuartia rubella* (Wahl.) Graebn.; Hultén, Fl. Alaska & Yuk. Pt. 4: 685 (1944), at least in part.

Liard R. between Nahanni Butte and Simpson, *Crickmay 38* (Can.); dry gravelly fan at base of granite mountain west of Brintnell L., *9481;* shale slopes and rock-slides on south slope of Red Mt., upper part of scrub timber and at 5000′, *9207, 9756;* rock-slides and crevices, north slope of Colonel Mt., alt. 4000′–6000′, *9414, 9654;* north peak of Nahanni Mt., *Wynne-Edwards 8468* (Can.).

Common at Brintnell L.; collected in flower late in June, and with maturing capsules about mid-July. Noted in Fl. Bor.-Am. as occurring on "Barren grounds, north of lat. 54°, to the Arctic Sea."

**Arenaria Rossii** R. Br. ex Richardson, Bot. App. Frankl. Journ. 738 (1823); Hooker, Fl. Bor.-Am. **1:** 100 (1830); Porsild in Sargentia **4:** 30 (1943), in Nat. Mus. Can. Bull. **101:** 19 (1945).

Shale crevices and slide rock on north slope of Colonel Mt., alt. 4000′–6000′, *9416, 9655;* Plains of Abraham, Canol Rd., mi. 82 E., alt. 6000′, *Porsild 11804* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alpine peak, alt. 5500′, *Wynne-Edwards 8294* (Can.).

Occasional to common at Brintnell L., even on the most unstable rock-slides; collected in flower early in July, and with maturing capsules late in July; found only on Colonel Mt. Porsild states that it is a very common species on limestone rubble of the higher mountain slopes along the Canol Rd.

**Arenaria humifusa** Wahl. Fl. Lapp. 129 (1812); Raup in Jour. Arn. Arb. **17:** 250 (1936); Porsild in Sargentia **4:** 30 (1943); Hultén, Fl. Alaska & Yuk. Pt. 4: 689 (1944); Porsild in Nat. Mus. Can. Bull. **101:** 19 (1945). See Nordhagen in Bergens Mus. Årsb. Nat. Rekke **1:** 24 (1935); Polunin in Nature **152:** 451, *map* (1943).

On mossy banks around an iron spring near west end of Brintnell L., *9238;* Plains of Abraham, Canol Rd., alt. 6000′, in wet limestone rubble, *Porsild 11803* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alpine slopes, *Wynne-Edwards 8291* (Can.).

Common in the single Brintnell L. habitat noted, but not seen elsewhere in that area. Porsild states that it is scarce on the Plains of Abraham. In flower late in June.

**Arenaria arctica** Stev. ex DC. Prodr. **1:** 404 (1824); Porsild in Sargentia **4:** 30 (1943), in Nat. Mus. Can. Bull. **101:** 19 (1945).

*Minuartia arctica* (Stev.) Asch. & Graebn.; Hultén, Fl. Alaska & Yuk. Pt. 4: 678 (1944).

Mackenzie R. between Blackwater R. and Norman, *Crickmay 164* (Can.); Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11805* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alpine slopes, *Wynne-Edwards 8287, 8288, 8289, 8290* (Can.).

This species is also known at Great Bear L., in the Richardson Mts., and along the arctic coast of Yukon (Porsild, l. c.).

**Arenaria macrocarpa** Pursh, Fl. Am. Sept. **1:** 318 (1814); Porsild in Sargentia **4:** 30 (1943), in Nat. Mus. Can. Bull. **101:** 19 (1945).

*Minuartia macrocarpa* (Pursh) Ostenf.; Hultén, Fl. Alaska & Yuk. Pt. 4: 682 (1944).

Alpine slopes south of Little Keele R., Canol Rd., mi. 55 E., alt. 4000′, *Porsild 11785* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alpine slope, alt. 5500′, *Wynne-Edwards 8292, 8293* (Can.).

**Arenaria uliginosa** Schleich. ex Lam. & DC. Fl. Franc. **4:** 786 (1805); Porsild in Sargentia **4:** 31 (1943), in Nat. Mus. Can. Bull. **101:** 19 (1945).

Sekwi R., Canol Rd., mi. 174 E., alt. 3625′, *Porsild 11862* (Can.).

An eastern arctic species previously collected by Porsild at Great Bear L. and in Keewatin.

**Arenaria sajanensis** Willd. ex Schlecht. in Berl. Gesell. Nat. Fr. Mag. **7:** 200 (1816); Porsild in Sargentia **4:** 30 (1943), in Nat. Mus. Can. Bull. **101:** 19 (1945).

Shale crevices on north slope of Colonel Mt., alt. 4000′–5000′, *9652;* northeast slope of Red Mt., alt. about 4500′, *9288, 9289;* mossy banks of small brook on west slope of Terrace Mt., alt. 5000′, *9561;* Plains of Abraham, Canol Rd., mi. 82 E., alt. 6000′, *Porsild 11806* (Can.).

Occasional at Brintnell L., and noted by Porsild as occasional in Macmillan Pass, along the Canol Rd. Found flowering in late June, and with mature capsules in the last week of July.

**Spergularia marina** (L.) Griseb. Spicil. Fl. Rumel. et Bith. **1:** 213 (1843); Rossbach in Rhod. **42:** 123 (1940).

*Arenaria rubra* var. *marina* L. Sp. Pl. 423 (1753).

*Arenaria rubra* L. sensu Hooker, Fl. Bor.-Am. **1:** 98 (1830).

*Spergularia media* sensu Macoun, Cat. Can. Pl. Pt. 1: 80 (1883), in part, non Presl.

*Spergularia salina* J. & C. Presl; Raup in Jour. Arn. Arb. **17:** 251 (1936).

Junction of Nyarling and Little Buffalo Rivers, *Russell 72* (G).

This species is common at the margins of saline flats and brine springs on the Salt Plains west of the Slave R. It was noted in Fl. Bor.-Am. "Between Cumberland House and Bear Lake," but I have seen no specimens from north of the Little Buffalo River.

**Silene acaulis** L. var. **exscapa** (All.) DC. Fl. Franc. **4:** 749 (1805); Raup in Jour. Arn. Arb. **17:** 251 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 694 (1944); Porsild in Nat. Mus. Can. Bull. **101:** 19, 31 (1945), in part. See Rhod. **23:** 120 (1921).

*Silene exscapa* All. Fl. Pedem. **2:** 83, *t. 79, f. 2* (1785).

*Silene acaulis* L. sensu Hooker, Fl. Bor.-Am. **1:** 87 (1830); Macoun, Cat. Can. Pl. Pt. 1: 68 (1883).

Liard R. between Nahanni Butte and Simpson, *Crickmay 35* (Can.); alpine meadows and crevices, north slope of Colonel Mt., *9400;* north peak of Nahanni Mt., *Wynne-Edwards 8470* (Can.); Bolstead Cr., Canol Rd., mi. 112 E., alpine slope, alt. 5500′, *Wynne-Edwards 8284* (Can.).

At Brintnell L. this variety is abundant on the north slope of Colonel Mt., but only occasional elsewhere in the area. On some of the steep rocky slopes above timber line the thick mats formed by it are a primary part of the ground cover. It also occurs in similar situations in the upper part of the timber. Flowering specimens collected July 5.

**Silene acaulis** L. var. **subacaulescens** (F. N. Williams) Fernald & St. John in Rhod. **23:** 120 (1921); Hultén, Fl. Alaska & Yuk. Pt. 4: 696 (1944).

*Silene acaulis* L. forma *subacaulescens* F. N. Williams in Jour. Linn. Soc. **32:** 101 (1896).

*Silene acaulis* L.; Porsild in Nat. Mus. Can. Bull. **101:** 31 (1945), in part.

North peak of Nahanni Mt., *Wynne-Edwards 8469* (Can.).

**Silene Menziesii** Hooker, Fl. Bor.-Am. **1:** 90, *t. 30* (1830). See Porsild in Rhod. **40:** 212 (1938).

South-facing slope in old field at Simpson, *9126.*

Apparently rather rare; just beginning to flower about mid-June. Hooker states that Richardson collected this species at "Portage d'embarras, Slave River," which is one of the portages at Smith Rapids. Until we collected it at Simpson, however, I had seen no material from the Mackenzie basin.

**Lychnis apetala** L. Sp. Pl. 437 (1753); Hooker, Fl. Bor.-Am. **1:** 91 (1830), at least in part; Macoun, Cat. Can. Pl. Pt. 1: 68 (1883), in part.

*Melandrium apetalum* (L.) Fenzl; Porsild in Sargentia **4:** 33 (1943), in Nat. Mus. Can. Bull. **101:** 19 (1945).

*Melandrium apetalum* (L.) Fenzl ssp. *arcticum* (Fries) Hultén, Fl. Alaska & Yuk. Pt. 4: 700 (1944).

Shale slide rock on north slope of Colonel Mt., alt. 4500′–6000′, *9659;* Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11802* (Can.).

Common on Colonel Mt., though scattered in the unstable slide rock; capsules mature in late July. Not observed on the mountains north of Brintnell L.

**Lychnis macrosperma** (Porsild) comb. nov.

*Melandrium macrospermum* Porsild in Rhod. **41:** 225, *t. 552, f. 1–3* (1939); Hultén, Fl. Alaska & Yuk. Pt. 4: 703 (1944); Porsild in Nat. Mus. Can. Bull. **101:** 19 (1945).

Bolstead Cr., Canol Rd., mi. 111 E., alpine slopes, *Wynne-Edwards 8285, 8286* (Can.).

Collected in flower July 25; previously known only in Alaska.

**Lychnis brachycalyx** sp. nov. Fig. 14.

Herba perennis, caudice brevi erecto vel ascendente, radicibus longis gracilibus; stipitibus singillatim ascendentibus non ramosis, 14–18 cm. altis, erectis vel basi

flexuosis, inferne dense breviterque pubescentibus, superne glanduloso-pubescentibus, valde purpurascentibus, nodis leviter incrassatis; foliis 3 vel 4 paribus, basalibus oblanceolatis vel spathulatis, 2–5 cm. longis, 4–9 mm. latis, fere ad petiolum basi contractis, apice obtusis, conspicue uninerviis, utrinque saltem vetustioribus glabris, margine breviter ciliatis; foliis stipitis inferioris oblanceo-

FIG. 14. *Lychnis brachycalyx* Raup, sp. nov.

latis vel anguste ellipticis, 3–4.5 cm. longis, apice obtusis vel acutis, basi leviter connatis, praeter costam et margines ciliatos glabris vel glabrescentibus; foliis stipitis superioris reductis, lanceolatis, 8–24 mm. longis, amplexicaulibus vel leviter connatis, apice obtusis vel acutis, subtus parce hirsutis, margine dense glanduloso-ciliatis; floribus singulis, calyce inflato late urceolato glanduloso-pubescente nervis diffusis purpurascentibus ornato, in sicco plerumque 11.5 mm.

crasso et 9 mm. alto, petalis vix exsertis; seminibus in sicco circiter 1 mm. latis, triangulari-reniformibus, rubro-fuscis, anguste alatis.

Shale cliffs in gorge on north slope of Colonel Mt., Brintnell L. area, alt. about 3500′, *9821* (TYPE).

Occasional in this situation, but not seen elsewhere; collected with mature capsules Aug. 16. These plants resemble single-flowered forms of *L. furcata* (Raf.) Fern. (see Rhod. **34**: 22–5, 1932) in habit, leaf-shape, pubescence, and seeds. The inflated calyces, however, are broader than high, a character which distinguishes *L. brachycalyx* from *L. furcata* as well as from other arctic species of *Lychnis* in this general affinity. In *L. furcata,* for instance, the calyx is 9–12 mm. broad and 12–15 mm. high.

## NYMPHAEACEAE

**Nuphar variegatum** Engelm. acc. to Durand in Ann. Rept. Univ. N. Y. **19**: 73 (1866); Porsild in Sargentia **4**: 37 (1943), in Nat. Mus. Can. Bull. **101**: 19 (1945).

*Nuphar luteum* sensu Hooker, Fl. Bor.-Am. **1**: 32 (1829), in part; Macoun, Cat. Can. Pl. Pt. 1: 32 (1883), in part; non Smith.

*Nymphozanthus variegatus* (Engelm.) Fernald; Raup in Jour. Arn. Arb. **17**: 251 (1936).

Northwest shore of Great Slave L., *Bedford* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 39* (Can.); Norman, *Coll.?* (N).

Common to abundant in the Athabaska–Great Slave L. region, and probably also throughout the Mackenzie valley. Hooker gives its range as the ". . . wooded country between lat. 54° and 64°," but Porsild reports it also in the Eskimo Lakes basin. He also notes it as fairly common at Great Bear L.

## RANUNCULACEAE

**Actaea rubra** (Ait.) Willd. Enum. Pl. 561 (1809); Hooker, Fl. Bor.-Am. **1**: 27 (1829); Raup in Jour. Arn. Arb. **17**: 252 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 716 (1944).

*Actaea spicata* L. var. *rubra* Ait. Hort. Kew. **2**: 221 (1789); Macoun, Cat. Can. Pl. Pt. 1: 27 (1883).

Fort Smith, *Raup 754, 757;* Resolution, *Preble 215* (US); same place, *E. A. & A. E. Preble 159* (US); Hay River, *Preble & Cary 21* (US); Mackenzie R., *Onion, Kennicott & Hardisty* (N); Simpson, *Coll.?* (N); damp thickets at Simpson, *9844;* thickets along rocky gullies on lower slopes of granite mountain west of Brintnell L., *9804.*

Occasional to common in the habitats above noted; fruit mature at Brintnell L. about mid-August. Noted in Fl. Bor.-Am. northward only to lat. 60°.

**Aquilegia brevistyla** Hooker, Fl. Bor.-Am. **1**: 24 (1829); Macoun, Cat. Can. Pl. Pt. 1: 24 (1883); Raup in Jour. Arn. Arb. **17**: 252 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 718 (1944).

Windy Pt., Great Slave L., *Hume 102662* (Can.); Old Fort Rae, *Russell* (Can.); dry water course near base of granite mountain west of Brintnell L., *9473;* in scrub timber on south slope of Red Mt., *9212.*

Occasional to common in these situations, but not observed elsewhere in the Brintnell L. area; collected in flower June 21, and with flowers and maturing capsules in mid-July. Noted in Fl. Bor.-Am. "As far north as Bear Lake." I have seen a Richardson specimen from Great Bear L. (Herb. Can.), and one from Good Hope collected by *Miss E. Taylor* (Can.).

**Delphinium glaucum** Wats. Bot. Calif. **2**: 427 (1880); Hultén, Fl. Alaska & Yuk. Pt. 4: 721 (1944); Porsild in Nat. Mus. Can. Bull. **101**: 19, 31 (1945).

*Delphinium scopulorum* Gray var. *glaucum* (Wats.) Gray; Raup in Jour. Arn. Arb. **17:** 252 (1936).

*Delphinium Brownii* Rydb.; Ewan in Univ. Colorado studies, Ser. D. **2:** 133 (1945).

Lower Slave R., *Russell 75* (G); Resolution, *Kennicott* (N); east shore of Trout L., *C. O. Hage* (G); Mackenzie R., *Onion* (N); thickets along dry gravelly watercourse, north slope of Colonel Mt., alt. 5000′, *9661;* crater-like hollow on summit of Lone Mt., *Wynne-Edwards 8471* (Can.); Nahanni Mts., *Preble & Cary 78* (US); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8303* (Can.); Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11235* (Can.).

Common along watercourses above timber line in the mountains; in flower in the latter part of July.

Ewan, in his recent "Synopsis of the North American species of Delphinium" (l. c.), maintains *D. Brownii* Rydb. as a species separate from *D. glaucum*. He gives the former a continental range in Alaska, Yukon, British Columbia, Alberta, and Wyoming, while the latter extends northward from California to western Washington. On page 67 of his monograph he states that they are distinct, though related; and on page 134 he cites photographic illustrations to show "the greater sturdiness of this interior species [*D. Brownii*] over *D. glaucum* . . . the stout rachises and crisp succulence of the leaves is notable." On page 223 there is a plate in which representatives of the two species are shown side by side, with the following note in the legend under *D. glaucum:* "contrast raceme and leaves with *D. Brownii* with which this species has been generally confused."

Ewan's keys, however, are arranged in sections which are determined geographically, and he does not give a general key to all the species of *Delphinium*. Furthermore, *D. glaucum* and *D. Brownii* do not both appear in any one section, so that nowhere are they distinguished from one another in the keys. A careful comparison of his somewhat detailed descriptions of the two (pp. 133, 134) also fails to reveal any significant differences, and the two plants shown in his plate appear to show no differences greater than those which commonly occur within either "species."

In the absence, therefore, of any clear distinctions I am continuing to consider *D. Brownii* as identical with Watson's *D. glaucum*, originally described from California. Ewan is probably correct in maintaining that *D. glaucum* should not be related to *D. scopulorum*. There seems to be nothing inconsistent about the combined range patterns of Ewan's two entities as shown by such groups of plants as are mapped in my *Figures 9-a* and *10*.

**Aconitum delphinifolium** DC. Syst. Nat. **1:** 380 (1818); Hultén, Fl. Alaska & Yuk. Pt. 4: 722 (1944); Porsild in Nat. Mus. Can. Bull. **101:** 19 (1945).

Nahanni Butte, Liard R., alt. 3800′, *Whittaker 100158* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 40* (Can.); gravelly thicket in swampy ground near west end of Brintnell L., *9432;* high alpine rock-slides, north slope of Colonel Mt., *9418;* scrub timber on south slope of Red Mt., *9210;* northeast slope of Red Mt., alt. 4500′–5000′, *9275;* mossy bank of brook on west slope of Terrace Mt., alt. 4800′, *9542;* Bolstead Cr., Canol Rd., mi. 111 E., alpine bog, alt. 4700′, *Wynne-Edwards 8303* (Can.).

Common at Brintnell L.; found flowering in late June and the first half of July. Wynne-Edwards collected flowering specimens on July 26. Noted by Porsild at Sekwi R. and Macmillan Pass, along the Canol Rd. The flowers of our no. *9542* are yellowish white, apparently representing an albino form of the species. White-flowered individuals have also been observed in northern British Columbia by Mrs. Mary G. Henry (Nat. Hort. Mag. 13: 271, 1934).

**Anemone parviflora** Michx. Fl. Bor.-Am. **1:** 319 (1803); Hooker, Fl. Bor.-Am. **1:** 5 (1829); Macoun, Cat. Can. Pl. Pt. 1: 12 (1883); Raup in Jour. Arn. Arb. **17:** 252 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 736 (1944); Porsild in Nat. Mus. Can. Bull. **101:** 19, 31 (1945).

Fort Smith, *Miss E. Taylor 955* (Can.); Pine Pt., Great Slave L., *Brooke* (Can.); Mackenzie R., *Onion* (N); Liard R. between Nahanni Butte and Simpson, *Crickmay 44* (Can.); mossy banks and muskeg thickets at west end of Brintnell L., *9242;* gravelly thickets and mossy shores, south side of Brintnell L., *9337, 9695;* wet ground along snow-fed stream, north slope of Colonel Mt., alt. 5000′, *9388;* damp hollow on Lone Mt., *Wynne-Edwards 8473, 8474* (Can.); north peak of Nahanni Mt., *Wynne-Edwards 8478* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., high alpine slopes, alt. 4400′–5500′, *Wynne-Edwards 8301, 8302* (Can.).

Occasional to common; or abundant in wet alpine meadows; mostly in fruit at low levels late in June, but occasional flowers found later in the summer; in flower at high elevations early in July. Wynne-Edwards collected flowering specimens at Bolstead Cr. as late as July 24 and 25. Porsild notes it as only occasional in Macmillan Pass. The plants collected around the shores of Brintnell L. are notable for their tall habit of growth (up to 35 cm.) and their large fruiting heads (1.5 cm. high).

**Anemone multifida** Poir. var. **hudsoniana** DC. Syst. **1:** 209 (1817); Raup in Jour. Arn. Arb. **17:** 253 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 31 (1945). See Fernald in Rhod. **19:** 140 (1917).

*Anemone multifida* Poir. sensu Hooker, Fl. Bor.-Am. **1:** 7 (1829); Hultén, Fl. Alaska & Yuk. Pt. 4: 730 (1944).

Fort Smith, *Miss E. Taylor 48* (Can.); same place, *Seton & Preble 78313* (Can.); same place, *Raup 774;* Resolution, *Kennicott* (N); Windy Pt., Great Slave L., *Hume 102663* (Can.); Old Fort Rae, *Russell* (Can.); Providence, *Preble & Cary 36* (US); same place, *Dutilly 87* (G); Liard R. between Nahanni Butte and Simpson, *Crickmay 43* (Can.); Simpson, *Onion, Kennicott & Hardisty* (N); south-facing slope in old field at Simpson, *9127;* dry dolomitic summit of Lone Mt., *Wynne-Edwards 8472* (Can.).

Common at Simpson; in flower June 13. Noted in Fl. Bor.-Am. ". . . to near the shores of the Arctic sea: common." I have seen specimens from Great Bear L. (*J. M. Bell,* Can.) and the lower Mackenzie (*Miss E. Taylor,* Can.).

**Anemone Richardsonii** Hooker, Fl. Bor.-Am. **1:** 6, *t. 4* (1829); Macoun, Cat. Can. Pl. Pt. 1: 13 (1883); Raup in Jour. Arn. Arb. **17:** 253 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 740 (1944); Porsild in Nat. Mus. Can. Bull. **101:** 19 (1945).

Wrigley, *Miss E. Taylor* (G); rich woods on lower south slope of Terrace Mt., alt. 3000′, *9684;* wet ground along snow-fed stream, north slope of Colonel Mt., alt. about 5000′, *9389;* along stream in upper valley of Frost Cr., alt. 4000′, *9276;* along small brook on west slope of Terrace Mt., alt. 5000′, *9559.*

Common to abundant in wet places along streams, particularly at high elevations; in flower late in June. The Fl. Bor.-Am. record for this species is ". . . barren ground, Rocky Mountains, from lat. 55° to 68°, in wet mossy ground." Porsild noted it as common in Macmillan Pass, and I have seen a specimen from Peel R.

**Anemone canadensis** L. Syst. ed. 12, **3:** App. 231 (1768); Raup in Jour. Arn. Arb. **17:** 253 (1936).

*Anemone pennsylvanica* L.; Hooker, Fl. Bor.-Am. **1:** 8, *t. 3, B* (1829).

*Anemone dichotoma* L.; Macoun, Cat. Can. Pl. Pt. 1: 13 (1883).

South bank of Mackenzie R., 10 mi. below Mills L., *Wynne-Edwards 8548* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 42* (Can.); low place in old field at Simpson, *9132.*

Common in the Simpson habitat; not yet in flower when collected on June 13. Noted in Fl. Bor. Am. ". . . from the United States to near the mouth of Mack-

enzie's River; not found in the barren grounds." Common in the Wood Buffalo Park, but I have seen no material from north of Simpson. There is a Richardson specimen in Herb. G marked "Arctic Nth. America," but without specific locality data.

**Anemone narcissiflora** L. Sp. Pl. 542 (1753); Porsild in Sargentia **4:** 38 (1943), in Nat. Mus. Can. Bull. **101:** 19 (1945).

*Anemone narcissiflora* L. ssp. *villosissima* (DC.) Hultén, Fl. Alaska & Yuk. Pt. 4: 732 (1944).

Alpine meadows, east slope of Red Mt., alt. 4500′–5500′, *9217;* meadow in dwarf birch scrub on southwest slope of Terrace Mt., alt. 4500′, *9685.*

Common to abundant in high alpine meadows at Brintnell L., and noted by Porsild in Macmillan Pass; in flower in the latter part of June, and in fruit early in August. Hultén has divided the American representatives of *A. narcissiflora* into four subspecies based upon the shape and cutting of leaves, the number of flowers per stem, and relative hairiness. All of these are notoriously fickle characters, and Hultén admits that the lines of demarkation are not clear. On the basis of geographic position our plants should represent his ssp. *interior,* but when keyed out they fall rather into his ssp. *villosissima.*

**Pulsatilla ludoviciana** (Nutt.) Heller, Cat. N. Am. Pl. ed. 2, 4 (1900); Raup in Jour. Arn. Arb. **17:** 253 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 20 (1945).

*Anemone ludoviciana* Nutt. Gen. Am. Pl. **2:** 20 (1818).

*Anemone patens* sensu Hooker, Fl. Bor.-Am. **1:** 4 (1829), non L.

*Anemone patens* L. var. *Nuttalliana* Gray; Macoun, Cat. Can. Pl. Pt. 1: 12 (1883).

*Anemone patens* L. ssp. *multifida* (Pritzel) Zamels; Hultén, Fl. Alaska & Yuk. Pt. 4: 738 (1944).

Fort Smith, *Seton & Preble 78314* (Can.); same place, *Raup 766, 2403;* Mackenzie R., *Onion, Kennicott & Hardisty* (N); Liard R. between Nahanni Butte and Simpson, *Crickmay 41* (Can.).

Common in the central Mackenzie basin, and probably also far northward. It was noted in Fl. Bor.-Am. as occurring ". . . in the central limestone tracts from lat. 45° to 67° on the Mackenzie." I have seen specimens from Great Bear L. (*J. M. Bell,* Can.) and the lower Mackenzie (*McConnell, Jones, Kennicott,* Can.). Porsild noted it in Macmillan Pass.

**Ranunculus trichophyllus** Chaix var. **typicus** Drew in Rhod. **38:** 18 (1936); Raup in Jour. Arn. Arb. **17:** 254 (1936); Porsild in Sargentia **4:** 39 (1943); Hultén, Fl. Alaska & Yuk. Pt. 4: 770 (1944).

*Ranunculus aquatilis* L.; Hooker, Fl. Bor.-Am. **1:** 10 (1829), in part.

*Ranunculus aquatilis* L. var. *capillaceus* DC. sensu Raup in Nat. Mus. Can. Bull. **74:** 134 (1935).

Little Buffalo R., *Russell 91* (G); northwest shore of Great Slave L., *Bedford* (Can.).

Common in the central Mackenzie basin and probably also far northward through the Mackenzie valley. Like most aquatics, it has been very little collected. Porsild has found it in the Mackenzie delta and in the Eskimo Lakes basin. In Fl. Bor.-Am. it is noted as extending northward ". . . to near the Arctic Sea, lat. 68°," but part of the material upon which this range was based probably represents other varieties of *R. trichophyllus* (See Porsild, l. c.).

**Ranunculus Gmelini** DC. var. **Purshii** (Richardson) Hara in Rhodora **41:** 386 (1939).

*Ranunculus Purshii* Richardson, Bot. App. Frankl. Journ. ed. 1, 741 (1823); Hooker, Fl. Bor.-Am. **1:** 15 (1829); Raup in Jour. Arn. Arb. **17:** 254 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 765 (1944).

*Ranunculus multifidus* sensu Macoun, Cat. Can. Pl. Pt. 1: 16 (1883), non DC.

*Ranunculus Gmelinii* DC. var. *terrestris* (Ledeb.) Benson in Bull. Torr. Bot. Cl. **69:** 313 (1942).

Smith Portage, *Miss E. Taylor 1109* (Can.); Resolution, *Miss E. Taylor 22* (G); northwest shore of Great Slave L., *Bedford* (Can.); Mackenzie R., *Coll.?* (N); Liard R. between Nahanni Butte and Simpson, *Crickmay 46* (Can.); swamp in wet woods, Simpson, *9144;* old stream channel in mud flats at west end of Brintnell L., *9709, 9805.*

Occasional to common; in flower at Brintnell L. about mid-August, and at Simpson about mid-June. Noted in Fl. Bor.-Am. ". . . from Canada to near the Arctic Sea."

**Ranunculus hyperboreus** Rottb. in Acta Univ. Hafn. **10:** 458 (1770); Raup in Jour. Arn. Arb. **17:** 254 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 757 (1944).

Pools in wet thickets at west end of Brintnell L., *9719.*

Occasional in the above habitat, and apparently rare in the Mackenzie basin. I have seen only one other specimen, from the Wood Buffalo Park (*Raup 2368*). Collected with maturing achenes early in August at Brintnell L.

**Ranunculus reptans** L. Sp. Pl. 549 (1753); Raup in Jour. Arn. Arb. **17:** 254 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 767 (1944); Porsild in Nat. Mus. Can. Bull. **101:** 33 (1945).

*Ranunculus Flammula* L. var. *major* and var. *intermedia* Hooker, Fl. Bor.-Am. **1:** 11 (1829).

*Ranunculus Flammula* L. var. *reptans* (L.) Meyer; Macoun, Cat. Can. Pl. Pt. 1: 17 (1883).

Northwest shore of Great Slave L., *Bedford* (Can.); Lake Grant, between Great Slave and Great Bear Lakes, *Preble 248* (US); south bank of Mackenzie R., 10 mi. below Mills L., *Wynne-Edwards 8550* (Can.).

Occasional to common in the central Mackenzie basin, and probably also in the upper Mackenzie valley. Hooker notes it as occurring "On the gravelly banks of rivers from Canada to lat. 69°." I have seen no specimens, however, from the country north of the areas cited above.

**Ranunculus pygmaeus** Wahl. Fl. Lapp. 157 (1812); Hultén, Fl. Alaska & Yuk. Pt. 4: 765 (1944); Porsild in Nat. Mus. Can. Bull. **101:** 20 (1945).

Bolstead Cr., Canol Rd., mi. 111 E., alpine slopes, *Wynne-Edwards 8300* (Can.); Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11234* (Can.).

Not otherwise known in the Mackenzie basin except in the mountains of northern British Columbia.

**Ranunculus nivalis** L. Sp. Pl. 553 (1753); Hultén, Fl. Alaska & Yuk. Pt. 4: 760 (1944); Porsild in Nat. Mus. Can. Bull. **101:** 20 (1945).

Along small brook on west slope of Terrace Mt., alt. 4800′, *9562;* Bolstead Cr., Canol Rd., mi. 111 E., alpine slopes, alt. 6000′, *Wynne-Edwards 8299* (Can.); Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11233* (Can.).

Apparently rare in the Brintnell L. area, but more common along the Canol Rd.; in flower in mid-July.

**Ranunculus Eschscholtzii** Schl. Animadv. Bot. Ranunc. Candollii **2:** 16, *t. 1* (1820); Hultén, Fl. Alaska & Yuk. Pt. 4: 751 (1944); Porsild in Nat. Mus. Can. Bull. **101:** 20 (1945).

Wet moss along small brook on west slope of Terrace Mt., alt. 4800′–5000′, *9539.*

Occasional in this situation, but not seen elsewhere in the Brintnell L. region; in flower about mid-July. Noted by Porsild as common in Macmillan Pass.

**Ranunculus lapponicus** L. Sp. Pl. 553 (1753); Hooker, Fl. Bor.-Am. **1:** 16 (1829); Macoun, Cat. Can. Pl. Pt. 1: 19 (1883); Raup in Jour. Arn. Arb. **17:** 254 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 758 (1944).

Mossy muskeg thickets at west end of Brintnell L., *9237, 9712.*

Common in the habitat noted above; in flower late in June, and with mature fruit early in August. Noted in Fl. Bor.-Am. ". . . from lat. 50° to the Arctic sea." I have seen a specimen from Arctic Red River (*Dutilly,* G).

**Ranunculus sceleratus** L. var. **multifidus** Nutt. in Torr. & Gray, Fl. N. Am. **1:** 19 (1838). See Benson in Bull. Torr. Bot. Cl. **69:** 312 (1942).

*Ranunculus sceleratus* L. sensu Hooker, Fl. Bor.-Am. **1:** 15 (1829); Macoun, Cat. Can. Pl. Pt. 1: 19 (1883); Raup in Jour. Arn. Arb. **17:** 255 (1936).

*Ranunculus sceleratus* L. ssp. *multifidus* (Nutt.) Hultén, Fl. Alaska & Yuk. Pt. 4: 768 (1944).

Northwest shore of Great Slave L., *Bedford* (Can.).

Noted in Fl. Bor.-Am. as extending ". . . from Canada to lat. 67°," but I have seen no material from below Great Slave L.

**Ranunculus Macounii** Britton in Trans. N. Y. Acad. Sci. **12:** 3 (1892); Raup in Jour. Arn. Arb. **17:** 255 (1936); Hultén, Fl. Alaska & Yuk. Pt. 4: 759 (1944); Porsild in Nat. Mus. Can. Bull. **101:** 33 (1945).

*Ranunculus hispidus* Michx. sensu Hooker, Fl. Bor.-Am. **1:** 19 (1829), at least in part.

*Ranunculus repens* var. *hispidus* (Michx.) T. & G., sensu Macoun, Cat. Can. Pl. Pt. 1: 21 (1883), at least in part.

Forth Smith, *Raup 741;* northwest shore of Great Slave L., *Bedford* (Can.); south bank of Mackenzie R., 10 mi. below Mills L., *Wynne-Edwards 8549* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 45* (Can.); Simpson, *Coll.?* (N); damp thicket along wood road just west of Simpson, *9881;* damp place in upland prairie west of the Mackenzie R. near Simpson, *9914.*

Occasional northward in the Mackenzie valley at least as far as Simpson. Noted in Fl. Bor.-Am. as occurring on "Banks of rivers from Canada to near the mouth of the Mackenzie River, lat. 67°." Hooker states that *R. pennsylvanicus* L. is "found with the last mentioned species [*R. hispidus* = *R. Macounii*], and it is equally diffused. . . ." I have seen no evidence of *R. pennsylvanica,* however, from north of the Athabaska–Peace delta region.

**Ranunculus acris** L. Sp. Pl. 554 (1753); Raup in Jour. Arn. Arb. **17:** 255 (1936).

Fort Smith, *Russell 30* (G).

Common as a weed around settlements in the central Mackenzie basin northward at least to Fort Smith, and probably also along the upper Mackenzie.

**Ranunculus Cymbalaria** Pursh, Fl. Am. Sept. **2:** 392 (1814); Hooker, Fl. Bor.-Am. **1:** 11 (1829); Macoun, Cat. Can. Pl. Pt. 1: 17 (1883); Raup in Jour. Arn. Arb. **17:** 256 (1936).

Fort Smith, *Raup 733;* Little Buffalo R., *Russell 65* (G).

I have seen no authentic material from north of the Little Buffalo R., though there is a specimen in Herb. N collected by *Onion, Kennicott & Hardisty* which may have come from the Mackenzie. The species is noted in Fl. Bor.-Am. as occurring ". . . from Canada to near the Arctic Sea, lat. 68°. . ."

**Thalictrum alpinum** L. Sp. Pl. 545 (1753); Hultén, Fl. Alaska & Yuk. Pt. 4: 773 (1944); Porsild in Nat. Mus. Can. Bull. **101:** 20, 31 (1945).

North Peak of Nahanni Mt., *Wynne-Edwards 8476* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., high alpine slopes, alt. 5500′, *Wynne-Edwards 8298* (Can.).

Porsild noted it as common in alpine tundra near the eastern end of Macmillan Pass, Canol Rd., mi. 220 E.

**Thalictrum occidentale** Gray in Proc. Am. Acad. **8:** 372 (1873).

Liard R. between Nahanni Butte and Simpson, *Crickmay 47* (Can.); fence row by plowed field at Simpson, *9133, 9134.*

Common in the Simpson habitat; in flower about mid-June. These specimens, representing both staminate and pistillate plants, are too immature for definite determination. They closely resemble *T. occidentale,* however, in habit, leaves, and flowers. I am unable also to place them in one of the varieties of *T. occidentale* recognized by Boivin (Rhod. **46:** 454–457, 1944).

**Thalictrum venulosum** Trel. in Proc. Bost. Soc. Nat. Hist. **23:** 302 (1886); Raup in Jour. Arn. Arb. **17:** 256 (1936); Boivin in Rhod. **46:** 439 (1944); Porsild in Nat. Mus. Can. Bull. **101:** 33 (1945).

*Thalictrum dioicum* sensu Hooker, Fl. Bor.-Am. **1:** 3 (1829), in part; Macoun, Cat. Can. Pl. Pt. 1: 14 (1883), in part; non L.

North shore of Great Slave L., *Hume 102664* (Can.); south bank of Mackenzie R., 10 mi. below Mills L., *Wynne-Edwards 8551* (Can.).

In Fl. Bor.-Am. *T. dioicum* is said to range ". . . from Canada to the banks of the Mackenzie R., in lat. 67°." That this may involve some other species than *T. venulosum* is suggested by the tentative determination of our Simpson specimens as *T. occidentale.*

**Caltha palustris** L. Sp. Pl. 558 (1753); Raup in Jour. Arn. Arb. **17:** 256 (1936).

*Caltha palustris* L. var. *arctica* (R. Br.) Hutch.; Hultén, Fl. Alaska & Yuk. Pt. 4: 711 (1944).

Near Pine Pt., Great Slave L., *Brooke* (Can.); near Big Island, Great Slave L., *Onion, Kennicott & Hardisty* (N); Wrigley Harbor, Great Slave L., *Kindle* (Can.).

Hultén maintains, perhaps rightly, that our northern American plants do not exactly match the typical European. He takes up for them the name var. *arctica,* based upon a much dwarfed plant from Melville Island described by Robert Brown. He considers this to be only an extremely reduced form of the American plant.

## PAPAVERACEAE

**Papaver radicatum** Rottb. in Skr. Kjøbenh. Selsk. Laerd. Vidensk. **10:** 455, *t. 8* (1770); Porsild in Sargentia **4:** 39 (1943); Hultén, Fl. Alaska & Yuk. Pt. 5: 805 (1945).

Mackenzie R. between Blackwater R. and Norman, *Crickmay 167* (Can.).

Noted by Porsild at Great Bear L.

**Papaver microcarpum** DC. Syst. Veg. **2:** 71 (1821); Porsild in Sargentia **4:** 39 (1943).

This species was collected at Norman on the Mackenzie by *Hume (103443,* Can.), just at the northern boundary of our area. Porsild reports it in the Richardson Mts., and on the arctic coast west of the Mackenzie.

**Papaver Keelei** A. E. Porsild in Nat. Mus. Can. Bull. **101:** 20 (1945).

Canol Rd., wet limestone rubble, Plains of Abraham, alt. 6000′, mi. 82 E., *Porsild 11807* (Can.); small tributary to Little Keele R., mi. 51 E., alt. 2200′, *Porsild 11782* (Can., TYPE COLL.); wet alpine meadow, Bolstead Cr., mi. 111 E., alt. 5500′, *Wynne-Edwards 8305, 8307* (Can.); same place, alpine peak, alt. 7000′, *Wynne-Edwards 8306.*

Porsild states that this species is common in places, apparently restricted to calcareous soils and preferring moist, springy places. Number *8306* was found in flower July 26, and the others were collected later and were in fruit.

**Corydalis pauciflora** (Steph.) Pers. Syn. Pl. **2**: 269 (1807); Hultén, Fl. Alaska & Yuk. Pt. 5: 810 (1945).

*Fumaria pauciflora* Steph. in Willd. Sp. Pl. **3**: 861 (1800).

Mossy banks of a small brook on west slope of Terrace Mt., alt. 4800′–5500′, *9526.*

Common in this place but not seen elsewhere in the Brintnell L. area. Collected with flowers and maturing capsules July 18.

**Corydalis sempervirens** (L.) Pers. Syn. Pl. **2**: 269 (1807); Raup in Jour. Arn. Arb. **17**: 256 (1936); Hultén, Fl. Alaska & Yuk. Pt. 5: 812 (1945).

*Fumaria sempervirens* L. Sp. Pl. 700 (1753).

*Corydalis glauca* Pursh; Hooker, Fl. Bor.-Am. **1**: 37 (1829); Macoun, Cat. Can. Pl. Pt. 1: 36 (1883).

Southwest and north shores of Great Slave L., *Howe 91980* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); east shore of Trout L., *C. O. Hage* (G); Mackenzie R. between Wrigley and Blackwater R., *Crickmay 133* (Can.).

Noted in Fl. Bor.-Am. as occurring "Throughout Canada, as far as lat. 64°."

**Corydalis aurea** Willd. Enum. Pl. Hort. Berol. *2*: 740 (1809); Hooker, Fl. Bor.-Am. **1**: 37 (1829); Macoun, Cat. Can. Pl. Pt. 1: 36 (1883); Raup in Jour. Arn. Arb. **17**: 256 (1936); Hultén, Fl. Alaska & Yuk. Pt. 5: 809 (1945).

Lower Slave R., *Raup 781;* Resolution, *Kennicott* (N); Providence, *Dutilly 63* (G); Simpson, *Onion, Kennicott & Hardisty* (N); sandy bank of Mackenzie R. opposite Simpson, *9947;* Mackenzie R. between Wrigley and Blackwater R., *Crickmay 134* (Can.).

Occasional; collected with flowers and mature capsules at Simpson late in August. Noted in Fl. Bor.-Am. "Throughout Canada to lat. 64°. . . in the woody country."

## CRUCIFERAE

**Draba alpina** L. Sp. Pl. 642 (1753); Hooker, Fl. Bor.-Am. **1**: 50 (1830); Macoun, Cat. Can. Pl. Pt. 1: 49 (1883); Hultén, Fl. Alaska & Yuk. Pt. 5: 846 (1945).

Liard R. between Nahanni Butte and Simpson, *Crickmay 48* (Can.).

**Draba alpina** L. var. **nana** Hooker in Trans. Linn. Soc. **14**: 363 (1825). See Fernald in Rhod. **36**: 285 (1934).

*Draba Bellii* Holm; Porsild in Nat. Mus. Can. Bull. **101**: 20 (1945).

Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11811* (Can.); high ridge east of pump station at Bolstead Cr., Canol Rd., mi. 111 E., alt. 6000′, *Wynne-Edwards 8314* (Can.); same locality, west slope of valley, *Wynne-Edwards 8312, 8313* (Can.).

**Draba fladnizensis** Wulf. var. **heterotricha** (Lindblom) Ball in Bull. Soc. Bot. Fr. **7**: 230 (1860). See Fernald in Rhod. **36**: 286 (1934).

*Draba lactea* Adams.; Hultén, Fl. Alaska & Yuk. Pt. 5: 857 (1945).

South slope of Red Mt., north of Brintnell L., near summit, alt. about 5900′, *9203;* shale cliffs above timber line on north slope of Colonel Mt., *9620.*

Occasional; collected in flower June 21 and in fruit July 28.

**Draba longipes** Raup in Contr. Arn. Arb. **6**: 165, *pl. 6* (1934); Hitchc. in Univ. Wash. Publ. Bot. **11**: 25 (1941); Hultén, Fl. Alaska & Yuk. Pt. 5: 858 (1945).

Gravelly beach on south shore of Brintnell L., *9336;* dry gravelly watercourse on north slope of Colonel Mt., alt. 5000′, *9616, 9617;* alpine meadow along brook, west slope of Terrace Mt., alt. 5000′, *9548.*

Common in the alpine habitats but rare at lake level; siliques mature in the latter half of July.

**Draba nivalis** Liljebl. var. **elongata** Wats. Proc. Am. Acad. **23**: 258, *f. 51c* (1888). See Hitchc. in Univ. Wash. Publ. Bot. **11**: 84 (1941).

Shale crevices and slide rock, south slope of Red Mt., alt. 5000′–5500′, *9785.*

Apparently rare or only occasional in our region; found with shattered siliques early in August. This material appears rather intermediate between *D. nivalis* and its var. *elongata* (= *D. lonchocarpa* Rydb.). Its siliques are variable in length from those similar to *D. nivalis* to those of the variety.

**Draba incerta** Payson in Am. Jour. Bot. **4:** 261 (1917); Porsild in Sargentia **4:** 42 (1943).

Liard R. between Nahanni Butte and Simpson, *Crickmay 49* (Can.).

Noted at Great Bear L. by Porsild (1. c.).

**Draba aurea** M. Vahl in Hornem. Fors. Oecan. Plantel. ed. 2: 599 (1806); Raup in Jour. Arn. Arb. **17:** 257 (1936); Porsild in Sargentia **4:** 41 (1943); Hultén, Fl. Alaska & Yuk. Pt. 5: 847 (1945).

Liard R. between Nahanni Butte and Simpson, *Crickmay 50* (Can.).

The Crickmay specimen is the only one yet available from southwestern Mackenzie. The species has been collected at L. Athabaska, and doubtful specimens have been collected by Porsild in the Mackenzie delta.

**Draba glabella** Pursh, Fl. Am. Sept. **2:** 434 (1814); Fernald in Rhod. **36:** 333 (1934); Raup in Jour. Arn. Arb. **17:** 257 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 20 (1945).

*Draba hirta* L. sensu Hultén, Fl. Alaska & Yuk. Pt. 5: 853 (1945), in part.

Shale slopes on south side of Red Mt., alt. 5000′, *9786, 9786-A;* Bolstead Cr., Canol Rd., mi. 111 E., in alpine bog, alt. 5000′, *Wynne-Edwards 8310, 8311* (Can.).

Occasional; siliques mature early in August.

**Draba praealta** Greene, Pittonia **3:** 306 (1898); Porsild in Sargentia **4:** 43 (1943).

Dry sandy plain near west end of Brintnell L., *9459;* shale cliffs in gorge on north slope of Colonel Mt., alt. 3500′, *9829;* alpine rock-slide, north slope of Colonel Mt., *9405-A.*

Occasional to common; mature siliques collected from mid-July to mid-August. Found at Great Bear L. by Porsild.

**Draba McCallae** Rydb. in Bull. Torr. Bot. Cl. **29:** 241 (1902). See Fernald in Rhod. **36:** 341–342 (1934); Hitchc. in Univ. Wash. Publ. Bot. **11:** 26 (1941).

*Draba aurea* M. Vahl, sensu Hitchc., l. c., in part.

Thicket on gravelly shore of Brintnell L. at Camp Pt., *9145;* along small brook on west slope of Terrace Mt., alt. 4500′–5000′, *9514.*

Occasional; collected with flowers and maturing siliques at lake-level on June 20, and with mature fruit at the higher altitudes about mid-July.

**Draba lanceolata** Royle, Illustr. Bot. Himal. Mts. **1:** 72 (1839); Fernald in Rhod. **36:** 357 (1934); Raup in Jour. Arn. Arb. **17:** 257 (1936); Hultén, Fl. Alaska & Yuk. Pt. 5: 857 (1945).

Alpine rock-slide, north slope of Colonel Mt., *9405;* shale cliffs in gorge on north slope of Colonel Mt., alt. 3500′, *9818;* shale crevices and rock-slides, north slope of Colonel Mt., alt. 5000′–6000′, *9618.*

Occasional to common, sometimes inhabiting very loose slide rock; collected with mature siliques in late July and the first half of August.

Nos. *9818* and *9618* have the habit of growth, pubescence, and commonly the twisted pods of typical *D. lanceolata,* but they differ from the latter in having the pods quite glabrous.

Records in Fl. Bor.-Am. for *Draba confusa* and *D. incana* in the Mackenzie basin may be referable to *D. lanceolata.* The first is noted as occurring ". . . north in the plains, nearly to the mouth of the Mackenzie River," and the second at "Bear Lake and the Mackenzie River."

**Draba cinerea** Adams. in Mem. Soc. Nat. Mosc. **5:** 103 (1817); Raup in Jour. Arn. Arb. **17:** 257 (1936); Hultén, Fl. Alaska & Yuk. Pt. 5: 849 (1945).

Shale slide rock, north slope of Colonel Mt., alt. 5000′–6000′, *9609.*

Occasional in this type of habitat; collected with mature siliques July 28. Also known in the Athabaska–Great Slave L. district.

**Draba nemorosa** L. Sp. Pl. 643 (1753); Macoun, Cat. Can. Pl. Pt. 1: 52 (1883); Raup in Jour. Arn. Arb. **17:** 257 (1936); Hultén, Fl. Alaska & Yuk. Pt. 5: 861 (1945). See Fernald in Rhod. **36:** 365 (1934); Hitchc. in Univ. Wash. Publ. Bot. **11:** 109 (1941).

Fort Smith, *Raup 808;* same place, *Seton & Preble 78316* (Can.); Resolution, *Kennicott* (N); cleared land on river bluff at Simpson, *9115.*

Common weed around settlements. Collected at Simpson with flowers and maturing siliques June 12. Both the typical form and the glabrous-fruited var. *lejocarpa* Lindbl. (Linnaea **13:** 33, 1839) are found in the Mackenzie basin, though the Simpson plants all represent the variety. The latter, under *D. lutea* Gilib., is noted in Fl. Bor.-Am. as extending ". . . from lat. 56° to 66°. . . ."

**Lesquerella arctica** (Wormsk.) Wats. in Proc. Am. Acad. **23:** 254 (1888); Porsild in Nat. Mus. Can. Bull. **101:** 33 (1945); Hultén, Fl. Alaska & Yuk. Pt. 5: 841 (1945).

*Alyssum arcticum* Wormsk. in Fl. Dan. 9, Fasc. 26, *t. 1520,* p. 3 (1814).

*Vesicaria arctica* (Wormsk.) Richardson; Hooker, Fl. Bor.-Am. **1:** 48 (1829); Macoun, Cat. Can. Pl. Pt. 1: 54 (1883).

Outwash gravel plain near mouth of North Nahanni R., *Wynne-Edwards 8536* (Can.).

Noted in Fl. Bor.-Am. ". . . on the summit of a hill 700 feet high, at Bear Lake River."

**Lepidium apetalum** Willd. Sp. Pl. **3:** 439 (1801); Raup in Jour. Arn. Arb. **17:** 257 (1936).

*Lepidium ruderale* sensu Hooker, Fl. Bor.-Am. **1:** 68 (1830), in part, non L.

*Lepidium densiflorum* Schrad. of auth., in part.

Mackenzie R., *Kennicott* (N).

Noted in Fl. Bor.-Am. as occurring ". . . from lat. 50° to 68°." There is a Hooker specimen, presumably collected during Franklin's Journeys, in Herb. N, but it has no locality data.

**Capsella Bursa-pastoris** (L.) Medic. Pfl. Gatt. **1:** 85 (1792); Hooker, Fl. Bor.-Am. **1:** 69 (1830); Raup in Jour. Arn. Arb. **17:** 257 (1936); Hultén, Fl. Alaska & Yuk. Pt. 5: 842 (1945).

Fort Smith, *Raup 797;* Resolution, *Preble 213* (US); cleared land on river bluff at Simpson, *9114.*

A common weed around settlements; collected with flowers and siliques about mid-June.

**Neslia paniculata** (L.) Desv. in Jour. Bot. **3:** 162 (1814); Raup, Jour. Arn. Arb. **17:** 258 (1936); Hultén, Fl. Alaska & Yuk. Pt. 5: 843 (1945).

Cultivated field west of the Mackenzie R. near Simpson, *9924.*

Occasional as a weed around settlements; siliques mature in late August.

**Brassica Kaber** (DC.) Wheeler var. **pinnatifida** (Stokes) Wheeler in Rhod. **40:** 308 (1938).

*Sinapis arvensis* L. *β pinnatifida* Stokes, Bot. Mater. Med. **3:** 478 (1812).

Cultivated field on west bank of Mackenzie R. near Simpson, *9929.*

Occasional as a weed in fields; collected with flowers and maturing fruit the last week in August.

**Thellungiella salsuginea** (Pall.) O. E. Schulz, Pflanzenr. Crucif. Sisymbr. 252 (1924); Porsild in Sargentia **4:** 40 (1943).

*Sisymbrium salsugineum* Pall. Reise **2:** App. 114, *t. 5* (1773); Raup in Jour. Arn. Arb. **17:** 258 (1936) (misspelled "*salsuginosum*"); Payson in Univ. Wyo. Publ. Sci. **1:** 17 (1922).

*Turritis ? diffusa* Hooker, Fl. Bor.-Am. **1:** 41 (1829); Macoun, Cat. Can. Pl. Pt. 1: 47 (1883).

This rare species has not been collected in the Mackenzie valley, but I have found it on the salt plains west of the upper Slave R., and Porsild has it from Liverpool Bay on the arctic coast east of the Mackenzie.

**Descurainia sophioides** (Fisch.) O. E. Schulz, Pflanzenr. Crucif. Sisymbr. 316 (1924); Raup in Jour. Arn. Arb. **17:** 258 (1936); Hultén, Fl. Alaska & Yuk. Pt. 5: 822 (1945).

*Sisymbrium sophioides* Fisch. apud Hooker, Fl. Bor.-Am. **1:** 61 (1830); Macoun, Cat. Can. Pl. Pt. 1: 46 (1883).

Twelve mi. east of Moraine Pt., northwest shore of Great Slave L., *Bedford* (Can.).

This species was observed growing on the river bluff at Simpson. Its range extends, according to Fl. Bor.-Am., ". . . to the shores of the Arctic sea, westward of the Mackenzie River." I have seen specimens from Fort Good Hope and Peel River.

**Descurainia Richardsonii** (Sweet) O. E. Schulz, Pflanzenr. Crucif. Sisymbr. 318 (1924); Raup in Jour. Arn. Arb. **17:** 258 (1936); Hultén, Fl. Alaska & Yuk. Pt. 5: 821 (1945).

*Sisymbrium Richardsonii* Sweet, Hort. Brit. ed. 2: 30 (1830).

*Sisymbrium canescens* sensu Hooker, Fl. Bor.-Am. **1:** 62 (1830), in part; Macoun, Cat. Can. Pl. Pt. 1: 46 (1883), in part; non Nutt.

*Sisymbrium brachycarpum* Richardson, sensu Hooker, Fl. Bor.-Am. **1:** 62 (1830), in part.

Resolution, *E. A. & A. E. Preble 148* (US); Providence, *Preble & Cary 31* (US); dry places, Simpson, *Miss E. Taylor* (Can., US); Norman, *Dutilly 49* (G); Mackenzie R., *Onion & Ross* (N).

**Braya humilis** (C. A. Mey.) Robins. Syn. Fl. N. Am. **1:** 141 (1895); Raup in Jour. Arn. Arb. **17:** 258 (1936); Porsild in Sargentia **4:** 45 (1943), in Nat. Mus. Can. Bull. **101:** 31 (1945).

*Sisymbrium humile* C. A. Mey. in Ledeb. Icon. Pl. Ross. **2:** 16, *t. 147* (1830); Hooker, Fl. Bor.-Am. **1:** 62 (1830); Macoun, Cat. Can. Pl. Pt. 1: 47 (1883).

*Torularia humilis* (C. A. Mey.) O. E. Schulz; Hultén, Fl. Alaska & Yuk. Pt. 5: 889 (1945).

Northwest shore of Great Slave L., *Bedford* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 51, 54* (Can.); Simpson, *Onion, Kennicott & Hardisty* (N); steep slope of river bluff at Simpson *9118;* same place, *Wynne-Edwards 8601* (Can.); sandy undercut bank of Mackenzie R. west of Simpson, *9918;* Bear Rock, Norman, *A. E. & R. T. Porsild 3383* (Can.); Lone Mt., *Wynne-Edwards 8477* (Can.); north peak of Nahanni Mt., *Wynne-Edwards 8478* (Can.).

Occasional to common in the Simpson district; collected in flower about mid-June, and with flowers and mature siliques late in August.

**Braya Henryae** Raup in Contr. Arn. Arb. **6:** 167, *t. 7, fig. 1* (1934).

*Braya purpurascens* sensu Porsild in Nat. Mus. Can. Bull. **101:** 21 (1945), non Bunge.

Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11812* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alpine slope, *Wynne-Edwards 8309* (Can.).

**Braya Richardsonii** (Rydb.) Fernald in Rhod. **20:** 203 (1918); Porsild in Nat. Mus. Can. Bull. **101:** 31 (1945).

*Pilosella Richardsonii* Rydb. in Torreya **7:** 159 (1907).

Porsild reports a doubtfully determined specimen of this species collected by *Wynne-Edwards* on the north peak of Nahanni Mt., *8479*.

**Erysimum cheiranthoides** L. Sp. Pl. 661 (1753); Hooker, Fl. Bor.-Am. **1**: 64 (1830); Macoun, Cat. Can. Pl. Pt. 1: 45 (1883); Raup in Jour. Arn. Arb. **17**: 258 (1936); Hultén, Fl. Alaska & Yuk. Pt. 5: 884 (1945).

Fort Smith, *Raup 799;* Lower Slave R., *Raup 798;* Great Slave L., *Onion, Kennicott & Hardisty* (N); Hay River, *Hume 102666* (Can.); northwest shore of Great Slave L., *Bedford* (Can.).

Noted in Fl. Bor.-Am. "Throughout Canada . . . to lat. 67° on the Mackenzie." I have seen specimens from Great Bear L., Good Hope, and Peel R.

**Erysimum inconspicuum** (Wats.) MacMillan, Metasperm. Minn. Valley, 268 (1892); Hultén, Fl. Alaska & Yuk. Pt. 5: 885 (1945).

*Erysimum asperum* DC. var. *inconspicuum* Wats. in King, Geol. Expl. 40th Par. **5**: 24 (1871).

*Erysimum lanceolatum* sensu Hooker, Fl. Bor.-Am. **1**: 64 (1830).

*Erysimum parviflorum* Nutt. (non Pers.); Macoun, Cat. Can. Pl. Pt. 1: 45 (1883); Raup in Jour. Arn. Arb. **17**: 258 (1936).

Mackenzie R., *Richardson* (Can.).

This species is only occasional in the Wood Buffalo Park, and judging by the rarity of more northern collections of it, it presumably is also occasional in the Mackenzie country. I have seen a specimen in Herb. Can. from the lower Mackenzie collected by *McConnell*.

**Erysimum Pallasii** (Pursh) Fernald in Rhod. **27**: 171 (1925); Hultén, Fl. Alaska & Yuk. Pt. 5: 885 (1945).

*Cheiranthus Pallasii* Pursh. Fl. Am. Sept. **2**: 436 (1814); Macoun, Cat. Can. Pl. Pt. 1: 48 (1883).

*Hesperis pygmaeus* Hooker, Fl. Bor.-Am. **1**: 60 (1830).

On a mountain above timber line, June 3, 1908, *Keele* (Can.).

This rare plant is known on the arctic coast and at Great Bear L. The above record is the only one to date in our region.

**Rorippa obtusa** (Nutt.) Britton in Mem. Torr. Bot. Cl. **5**: 169 (1894); Raup in Jour. Arn. Arb. **17**: 259 (1936); Porsild in Sargentia **4**: 40 (1943).

*Nasturtium obtusum* Nutt. in T. & G. Fl. N. Am. **1**: 74 (1838).

Not yet collected on the upper Mackenzie, but found in the Wood Buffalo Park and in the Mackenzie delta (Porsild, l. c.).

**Rorippa islandica** (Oeder) Borbás var. **microcarpa** (Regel) Fernald in Rhod. **42**: 271 (1940). See Rhod. **42**: 25–32 (1940).

*Nasturtium palustre* DC. var. *microcarpa* Regel in Mém. Acad. Imp. Sci. St. Pétersb. VII. **4**, no. 4 (Tent. Fl. Ussur.): 20 (1861).

*Nasturtium palustre* DC. sensu Hooker, Fl. Bor.-Am. **1**: 39 (1829), in part.

*Rorippa palustris* (L.) Bess. var. *glabrata* (Lunell) Victorin; Raup in Jour. Arn. Arb. **17**: 259 (1936).

Resolution, *Onion, Kennicott & Hardisty* (N); 12 mi. east of Moraine Pt., northwest shore of Great Slave L., *Bedford* (Can.); stony shore of Brintnell L. at Camp Pt., *9377;* wet mossy shore of Brintnell L. near Camp Pt., *9489*.

Occasional to common; collected with flowers and maturing capsules about mid-July. Noted in Fl. Bor.-Am. ". . . to the shores of the Arctic Sea. . . ."

**Barbarea orthoceras** Ledeb. in Index Sem. Hort. Dorpat (1824); Raup in Jour. Arn. Arb. **17**: 259 (1936); Hultén, Fl. Alaska & Yuk. Pt. 5: 825 (1945).

*Barbarea praecox* sensu Hooker, Fl. Bor.-Am. **1**: 39 (1829), in part, non Sm.

*Barbarea vulgaris* R. Br. var. *stricta* sensu Macoun, Cat. Can. Pl. Pt. 1: 45 (1883), in part, non Regel.

Northwest shore of Great Slave L., *Bedford* (Can.); Rae, *Russell* (Can.); Wrigley Harbor, Great Slave L., *Kindle* (Can.); "Canada to Lat. 68°," "Mack. River," *Richardson* (Can.).

**Cardamine bellidifolia** L. Sp. Pl. 654 (1753); Hultén, Fl. Alaska & Yuk. Pt. 5: 832 (1945).

Stony beaches and thickets near shore of Brintnell L. at Camp Pt., *9152;* shale cliffs with north exposure, summit of Red Mt., alt. 5900′, *9765;* crevices and stony stream channels, northeast slope of Red Mt., alt. 4500′–5500′, *9272;* mossy banks of small brook on west slope of Terrace Mt., alt. 5000′, *9541.*

Occasional to common; siliques beginning to mature at lake-level late in June, but plants found in flower at high elevations as late as mid-July. Noted in Fl. Bor.-Am. as occurring "Throughout Arctic America, *sparingly.*"

**Cardamine pratensis** L. Sp. Pl. 656 (1753); Hooker, Fl. Bor.-Am. **1**: 45 (1829), in part; Macoun, Cat. Can. Pl. Pt. 1: 41 (1883), in part; Hultén, Fl. Alaska & Yuk. Pt. 5: 834 (1945); Porsild in Nat. Mus. Can. Bull. **101**: 20 (1945). See Rhod. **22**: 11–14 (1920).

Muskeg thickets at west end of Brintnell L., *9236.*

Occasional in this habitat; collected with flowers and immature siliques June 23. Noted in Fl. Bor.-Am. as occurring "Throughout Arctic America." Porsild reports that he observed it in Macmillan Pass, on the Canol Rd., mi. 225 E.

The Brintnell L. plants are near var. *angustifolia* Hooker (l. c.), but the lateral leaflets of some of the basal leaves are distinctly broad ovate as in the typical form. It is of interest that the lower leaves and petioles have the strigose pubescence mentioned by Porsild as characteristic of his Alaskan material (Rhod. **41**: 234, 1939). This appears to relate the plants to some northern Eurasian and European alpine forms rather than to the northeastern American forms which lack the pubescence.

**Cardamine pratensis** L. var. **palustris** Wimm. & Grab. Fl. Siles. **2**: Pt. 1, 266 (1829); Raup in Jour. Arn. Arb. **17**: 259 (1936).

Northwest shore of Great Slave L., *Bedford* (Can.); wet swamp in low woods near Simpson, *9101.*

Common at the Simpson locality, but not seen elsewhere; in flower June 12. I have seen a specimen also from Peel R., in the lower Mackenzie region.

**Cardamine pennsylvanica** Muhl. apud Willd. Sp. Pl. **3**: 486 (1800); Raup in Jour. Arn. Arb. **17**: 259 (1936).

*Cardamine hirsuta* sensu Hooker, Fl. Bor.-Am., **1**: 45 (1829); Macoun, Cat. Can. Pl. Pt. 1: 41 (1883); in part, non L.

This species has not been collected along the upper Mackenzie, but it is common in upland muskegs in the Wood Buffalo Park. In Fl. Bor.-Am. it is noted as extending ". . . to the shores of the Arctic Sea." There are Richardson specimens in Herbs. N and Can. labeled "Franklins Journey" and "Arctic N. A.," both originally marked *C. hirsuta,* but without specific locality data.

**Eutrema Edwardsii** R. Br., Suppl. to App. Parry's 1st Voy. 267, *t. A* (1824); Hultén, Fl. Alaska & Yuk. Pt. 5: 819 (1945); Porsild in Nat. Mus. Can. Bull. **101**: 20 (1945).

Plains of Abraham, Canol Rd., mi. 82 E., alt. 6000′, *Porsild 11808* (Can.); alpine meadow, Bolstead Cr., Canol Rd., mi. 111 E., alt. 4500′–5500′, *Wynne-Edwards 8308* (Can.).

Noted by Porsild as rare in the *Cassiope tetragona* communities on the Plains of Abraham.

**Parrya nudicaulis** (L.) Regel in Bull. Mosc. **34**: Pt. 2, 176 (1861); Hultén, Fl. Alaska & Yuk. Pt. 5: 890 (1945), in part; Porsild in Nat. Mus. Can. Bull. **101**: 21 (1945).

*Cardamine nudicaulis* L. Sp. Pl. 654 (1753).

Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11810* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8316, 8317* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11963* (Can.).

Hultén (1. c.) has proposed a ssp. *interior* for plants with leaves lanceolate or broadly lanceolate, obtuse or subacute, entire or nearly so; with filaments dilated at the middle or toward the base; and with slender pods and long styles. The above specimens may represent this subspecies.

**Melanidion boreale** Greene in Ottawa Nat. **25**: 146 (1912); Porsild in Nat. Mus. Can. Bull. **101**: 21 (1945).

*Ermania borealis* (Greene) Hultén, Fl. Alaska & Yuk. Pt. 5: 878 (1945).

Barren wind-swept hill in limestone rubble, Plains of Abraham, Canol Rd., mi. 82 E., alt. 6000′, *Porsild 11809* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., in limestone scree, *Wynne-Edwards 8318* (Can.); Sekwi R., Canol Rd., mi. 174 E., alt. 3625′, in limestone scree, *Porsild 11865* (Can.).

The recent discussions by Hultén and Porsild (1. c.) have greatly enlarged our understanding of this rare species. Hultén has reduced *Melanidion* to the genus *Ermania*, which was described by Chamisso in 1831 (Linnaea **6**: 533) from material collected in Kamtchatka. The type species of *Ermania* was *E. parryoides*, which was placed in the genus *Parrya* by Hultén in his Flora of Kamtchatka (p. 172, 1928). For this plant Hultén took up the name *Parrya Ermani* Ledeb. (Fl. Ross. **1**: 132, 1842). It is very difficult for me to identify the unique *Melanidion*, which has striking racemes of purple flowers and short pods, with anything in the genus *Parrya*, including the *Parrya Ermani* of Kamtchatka. I am therefore following Porsild in retaining Greene's genus.

**Arabis lyrata** L. var. **kamchatica** Fisch. ex DC. Syst. Veg. **2**: 231 (1821). See Rollins in Rhod. **43**: 360 (1941).

*Sisymbrium arabidoides* Hooker, Fl. Bor.-Am. **1**: 63 (1830).

*Arabis lyrata* L. var. *glabra* (DC.) Hopkins in Rhod. **39**: 93 (1937); Porsild in Nat. Mus. Can. Bull. **101**: 21 (1945).

*Arabis lyrata* L. ssp. *kamchatica* (Fisch.) Hultén, Fl. Aleut. I, 202 (1937); Fl. Alaska & Yuk. Pt. 5: 875 (1945).

Stony beach of Brintnell L. at Camp Pt., *9153, 9694;* shale crevices and alpine rock-slides, north slope of Colonel Mt., alt. 5000′–6000′, *9408, 9619;* along stream in upper valley of Frost Cr., alt. 4000′, *9564;* shaly south slope of Red Mt., alt. 5000′, *9723*.

Occasional to common, especially in alpine slide rock; found with flowers and mature siliques at lake-level June 21, and in flower above timber line as late as mid-July. Noted by Porsild (1. c.) in Macmillan Pass along the Canol Rd., and in Fl. Bor.-Am. ". . . from Canada to lat. 68°." There are specimens in Herbs. G, N, and Can. labeled "Fl. Bor.-Am.," "Franklin's Journey," and "Arctic Canada," but none have specific locality data.

The occurrence of typical *Arabis lyrata* in southwestern Mackenzie is somewhat in doubt. Hopkins (1. c., 91) regarded the typical form as mainly confined to eastern America, but considered one of my numbers from the Wood Buffalo Park

(*2485*) as representing it. Porsild (Sargentia **4**: 43) collected several numbers at Great Bear L., all of which he listed as *A. lyrata.* Rollins (1. c.), on the other hand, does not recognize typical *A. lyrata* west of the 100th meridian, although he regards var. *kamchatica* as a poorly defined segregate. The appearance of the eastern form in the Mackenzie country is, of course, not inconsistent with other range patterns.

**Arabis hirsuta** (L.) Scop. var. **pycnocarpa** (Hopkins) Rollins in Rhod. **43:** 318 (1941).

*Turritis hirsuta* L. Sp. Pl. **2:** 666 (1753).

*Arabis pycnocarpa* Hopkins in Rhod. **39:** 112 (1937).

*Arabis hirsuta* (L.) Scop., sensu Hooker, Fl. Bor.-Am. **1:** 42 (1829), in part; Macoun, Cat. Can. Pl. Pt. 1: 42 (1883), in part; Raup in Jour. Arn. Arb. **17:** 260 (1936).

*Arabis hirsuta* (L.) Scop. ssp. *pycnocarpa* (Hopkins) Hultén, Fl. Alaska & Yuk. Pt. 5: 873 (1945).

Resolution, *Dutilly 100* (G); Mackenzie R., *Kennicott* (N); clearing at Simpson, *9108;* upland prairie west of the Mackenzie R. near Simpson, *9897.*

Occasional; in flower about mid-June, and found with mature and shattered siliques late in August. Noted in Fl. Bor.-Am. ". . . from Canada to lat. 68°," and I have seen a specimen from Good Hope (*Onion,* N).

**Arabis Holboellii** Hornem. in Fl. Dan. **11:** 5, *t. 1879* (1827); Porsild in Sargentia **4:** 43 (1943); Hultén, Fl. Alaska & Yuk. Pt. 5: 874 (1945). See Rollins in Rhod. **43:** 439 (1941).

Mossy thickets on stony shore of Brintnell L., *9155;* gravelly slope in gorge on north slope of Colonel Mt., alt. 3300′, *9837;* scrub timber on south slope of Red Mt., alt. about 4000′, *9219, 9778.*

Occasional; collected with flowers and immature siliques late in June, and with mature fruit early in August.

**Arabis Holboellii** Hornem. var. **retrofracta** (Graham) Rydb. in Contr. U. S. Nat. Herb. **3:** 484 (1896); Rollins in Rhod. **43:** 441 (1941); Hultén, Fl. Alaska & Yuk. Pt. 5: 874 (1945).

*Arabis retrofracta* Graham in Edinb. New Phil. Jour. 344 (1829); Macoun, Cat. Can. Pl. Pt. 1: 43 (1883); Hopkins in Rhod. **39:** 179 (1937); Raup in Jour. Arn. Arb. **17:** 260 (1936).

*Turritis retrofracta* (Graham) Hooker, Fl. Bor.-Am. **1:** 41 (1829).

Fort Smith, *Miss E. Taylor 1683* (Can.); Windy Pt., Great Slave L., *Hume 102665* (Can.); Mackenzie R., *Onion, Kennicott & Hardisty* (N); Liard R. between Nahanni Butte and Simpson, *Crickmay 52* (Can.).

Noted in Fl. Bor.-Am. ". . . from Canada to lat. 68°; at the Mackenzie River." I have seen a specimen from Good Hope (*Onion,* N).

**Arabis divaricarpa** A. Nels. in Bot. Gaz. **30:** 193 (1900); Raup in Jour. Arn. Arb. **17:** 260 (1936); Hopkins in Rhod. **39:** 129 (1937); Rollins in Rhod. **43:** 374 (1941); Hultén, Fl. Alaska & Yuk. Pt. 5: 871 (1945).

Providence, *Preble & Cary 32* (US); dry slopes, Simpson, *Miss E. Taylor 120* (Can.); south-facing slope in old field, Simpson, *9125;* Liard R. between Nahanni Butte and Simpson, *Crickmay 53* (Can.).

Occasional; in flower about mid-June. All of the above specimens represent the typical form.

**Arabis Drummondii** Gray in Proc. Am. Acad. **6:** 187 (1866); Raup in Jour. Arn. Arb. **17:** 260 (1936); Hopkins in Rhod. **39:** 136 (1937); Rollins in Rhod. **43:** 369 (1941); Porsild in Sargentia **4:** 43 (1943); Hultén, Fl. Alaska & Yuk. Pt. 5: 871 (1945).

Dry openings in upper part of timber, south slope of Red Mt., *9677;* on undercut banks in upper valley of Frost Cr., alt. 4000′, *9521.*

Occasional; found with maturing capsules and a few flowers about mid-July. Occasional in the Wood Buffalo Park, and collected by Porsild at Great Bear L. and in the Richardson Mts.

DROSERACEAE

**Drosera rotundifolia** L. Sp. Pl. 281 (1753); Hooker, Fl. Bor.-Am. **1**: 81 (1830); Macoun, Cat. Can. Pl. Pt. 1: 165 (1883); Raup in Jour. Arn. Arb. **17**: 261 (1936); Hultén, Fl. Alaska & Yuk. Pt. 5: 893 (1945).

Great Slave L., *R. Bell 23170* (Can.); southwest and north shores of Great Slave L., *Howe 91976* (Can.).

Noted in Fl. Bor.-Am. ". . . as far north as the Arctic Circle."

**Drosera anglica** Huds. Fl. Angl. ed. 2: 135 (1778); Raup in Jour. Arn. Arb. **17**: 261 (1936); Porsild in Sargentia **4**: 47 (1943); Hultén, Fl. Alaska & Yuk. Pt. 5: 893 (1945).

This species has not yet been observed on the upper Mackenzie, but I have collected it at L. Athabaska, and Porsild has it from Great Bear L.

CRASSULACEAE

**Sedum roseum** (L.) Scop. var. **integrifolium** (Raf.) Berger in Engl. & Prantl, Nat. Pflanzenf. 2 Aufl. **18a**: 440 (1930).

*Rhodiola integrifolia* Raf. Atl. Jour. **1**: 146 (1832); Porsild in Nat. Mus. Can. Bull. **101**: 22 (1945).

*Sedum roseum* (L.) Scop. ssp. *integrifolium* (Raf.) Hultén, Fl. Alaska & Yuk. Pt. 5: 895 (1945).

Dry gravelly watercourse on north slope of Colonel Mt., alt. 5000′, *9622;* south slope of Red Mt., alt. 4000′, *9226.*

Common on alpine summits and rocky slopes at Brintnell L.; in flower late in June, and with maturing capsules late in July. Porsild also notes it as common in Macmillan Pass, along the Canol Rd.

SAXIFRAGACEAE

**Saxifraga rivularis** L. Sp. Pl. 404 (1753); Hultén, Fl. Alaska & Yuk. Pt. 5: 935 (1945); Porsild in Nat. Mus. Can. Bull. **101**: 22 (1945).

Wet mossy banks of small brook on west slope of Terrace Mt., alt. 4800′–5500′, *9524;* Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8333* (Can.).

Common at the Terrace Mt. station but not seen elsewhere in the Brintnell L. area. Porsild notes it as common in Macmillan Pass.

**Saxifraga cernua** L. Sp. Pl. 403 (1753); Hultén, Fl. Alaska & Yuk. Pt. 5: 910 (1945); Porsild in Nat. Mus. Can. Bull. **101**: 22 (1945).

Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8321* (Can.).

**Saxifraga sibirica** L. Syst. ed. 10: 1027 (1759).

Damp and shaded mossy bank in gorge on north slope of Colonel Mt., alt. 3300′, *9836.*

Apparently rare, and found only in this single locality; collected with immature capsules and the dried remains of flowers on Aug. 16.

This species does not seem to have been reported previously on the North American continent, and it is not recorded in the Bering Sea region or neighboring parts of eastern Siberia. It has a wide range in central Asia, extending, according to Hultén (Dist. of Arct. and Bor. Biota, 18), westward to the Urals. It is also known in the Caucasus. Our plants are a good match for many specimens of *S. sibirica* in the Gray Herbarium. They have rather long, obovate-

cuneate petals (1 cm. long) and ovate-oblong sepals (3.5 mm. long), and their rounded-reniform leaves have lobes that are rounded to almost broadly truncate at the apex. The stems, peduncles, and hypanthia, as well as the calyx-lobes in part, are finely glandular-pubescent.

The nearest American relative of *S. sibirica* is *S. debilis* Engelm., described from a collection by Parry in the Rocky Mountains in 1862 (ex Gray, Proc. Acad. Phil., 1863, p. 62). The type of this species (in the Gray Herbarium) is almost completely glabrous, with ovate sepals 1.5–2 mm. long, and cuneate to oblong petals 3–7 mm. long. The lobes of its leaves are not so rounded as in *S. sibirica,* in some even being acute; also the lobes are not so rounded below or overlapping in the sinuses as in the latter species. Occasional specimens of *S. debilis* in the Gray Herbarium have finely pubescent stems, but are not glandular except on the hypanthium (See *A. Nelson 2447,* Dome L., Wyo.). The range of *S. debilis* does not appear to extend north of Montana and Mt. Rainier (See N. Am. Fl. **22**: Pt. **2**, 128).

Engler and Irmscher (Pflanzenreich **67** [IV. 117.1]: 262) distinguish *S. sibirica* and some other Old World species from *S. debilis* as follows:

Caules floriferi pluriflori, interdum 1–2-flori, floribus breviter pedicellatis.....*S. sibirica.*
Caules floriferi 1–2-flori, floribus longius pedicellatis.....*S. debilis.*

To these differences might well be added the size of the flowers, for the American species has consistently shorter petals and sepals than *S. sibirica.* Many Asiatic specimens of *S. sibirica* in the Gray Herbarium collection have long-pediceled flowers, 1 or 2 to the plant. Following Engler & Irmscher's subdivision of *S. sibirica* (l. c., pp. 264–267), these forms fall into var. *pekinensis* (Maxim.) Engl. & Irmsch., and are most nearly related to our Mackenzie Mountain plants, each of which has only 1 or 2 flowers, on peduncles 2.5–3 cm. long.

**Saxifraga nivalis** L. Sp. Pl. 401 (1753); Hultén, Fl. Alaska & Yuk. Pt. 5: 924 (1945).

Shale cliffs on upper slopes and summit of Red Mt., alt. 5500′–5900′, *9766.*

Apparently rare; capsules mature early in August.

**Saxifraga hieracifolia** Waldst. & Kit. Pl. Rar. Hung. **1**: 17, *t. 18* (1802); Hultén, Fl. Alaska & Yuk. Pt. 5: 918 (1945); Porsild in Nat. Mus. Can. Bull. **101**: 22 (1945).

Bolstead Cr., Canol Rd., mi. 111 E., alpine ridge, alt. 5000′–6000′, *Wynne-Edwards 8323, 8324* (Can.).

**Saxifraga Lyallii** Engler in Verh. Zool.-Bot. Ges. Wien. 542 (1869); Hultén, Fl. Alaska & Yuk. Pt. 5: 922 (1945); Porsild in Nat. Mus. Can. Bull. **101**: 22 (1945).

Among soil polygons near iron spring in upper valley of Frost Cr., north of Brintnell L., alt. 4500′, *9560;* Bolstead Cr., Canol Rd., mi. 111 E., alpine slopes up to alt. 7000′, *Wynne-Edwards 8325, 8326, 8327* (Can.); Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11240* (Can.).

Apparently rare or occasional at Brintnell L., but more common along the Canol Rd. Among the soil polygons mentioned above it was the only vascular plant growing in the frost-heaved finer soils. Collected with flowers and immature capsules July 18.

**Saxifraga punctata** L. Sp. Pl. 401 (1753); Hultén, Fl. Alaska & Yuk. Pt. 5: 928 (1945); Porsild in Nat. Mus. Can. Bull. **101**: 22 (1945). See Hultén, Fl. Aleut. I. 213–214 (1937), and Porsild in Rhod. **41**: 242 (1939) for recent discussions of this species.

Along stream in upper valley of Frost Cr., alt. 4500′, *9515;* along small stream on east slope of Red Mt., and in high shale crevices, alt. 4000′–5500′, *9273;* mossy banks of brook, west slope of Terrace Mt., alt. 4800′–5500′, *9551.*

In general rare or occasional, but abundant locally; collected with flowers and maturing fruit about mid-July. Our plants answer the description of those collected by Porsild in Alaska, and seem to approach the ssp. *insularis* proposed by Hultén. Noted by Porsild as common in Macmillan Pass, along the Canol Rd.

**Saxifraga radiata** Small in N. Am. Fl. **22:** 128 (1905); Hultén, Fl. Alaska & Yuk. Pt. 5: 933 (1945); Porsild in Nat. Mus. Can. Bull. **101:** 22 (1945).

Gravelly thickets, south shore of Brintnell L., *9335;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11239* (Can.).

Apparently rare or occasional at Brintnell L., and noted by Porsild as rare in an alpine meadow in Macmillan Pass. Collected in flower June 30.

**Saxifraga aizoides** L. Sp. Pl. 403 (1753); Raup in Jour. Arn. Arb. **17:** 261 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 22, 31 (1945).

Liard R. between Nahanni Butte and Simpson, *Crickmay 56-A* (Can.); Smith Cr., 4 mi. above mouth, *Crickmay 24* (Can.); dry gravelly fan at base of granite mountain west of Brintnell L., *9477;* alpine crevices and rock-slides, north slope of Colonel Mt., alt. 4000′–6000′, *9406, 9651;* Lone Mt., *Wynne-Edwards 8480* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8322* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11867* (Can.).

Common to abundant on Colonel Mt., at Brintnell L., but apparently rare or occasional elsewhere in that area; in flower about mid-July.

**Saxifraga tricuspidata** Rottb. in Skr. Kjöbenh. Selsk. Laerd. Vidensk. **10:** 446, *t. 6, f. 21* (1770); Hooker, Fl. Bor.-Am. **1:** 254 (1834); Macoun, Cat. Can. Pl. Pt. 1: 154 (1883); Raup in Jour. Arn. Arb. **17:** 261 (1936); Hultén, Fl. Alaska & Yuk. Pt. 5: 939 (1945); Porsild in Nat. Mus. Can. Bull. **101:** 22, 31 (1945).

Resolution, *Kennicott* (N); same place, *Preble 235* (US); southwest and north shores of Great Slave L., *Howe 91970* (Can.); Windy Pt., Great Slave L., *Hume 102667* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 58* (Can.); Mackenzie R. between Blackwater R. and Norman, *Crickmay 168* (Can.); gravelly thickets on shore of Brintnell L., near camp, *9312;* south slope of Red Mt., *9225;* Lone Mt., *Wynne-Edwards 8482* (Can.); north peak of Nahanni Mt., *Wynne-Edwards 8483* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8320* (Can.).

One of the most abundant species on high alpine slopes and in unstable situations at lower altitudes. On many high ledges and loose rocky slopes it is one of the primary plants of the scanty cover. Collected in flower in middle and late June. Noted in Fl. Bor.-Am. "From Lake Winipeg . . . to the Arctic Sea . . ."

**Saxifraga serpyllifolia** Pursh, Fl. Am. Sept. **1:** 310 (1814); Hultén, Fl. Alaska & Yuk. Pt. 5: 937 (1945); Porsild in Nat. Mus. Can. Bull. **101:** 22 (1945).

Bolstead Cr., Canol Rd., mi. 111 E., on alpine ridge, alt. 7000′, *Wynne-Edwards 8334* (Can.).

**Saxifraga Hirculus** L. Sp. Pl. 402 (1753); Hooker, Fl. Bor.-Am. **1:** 252 (1834); Macoun, Cat. Can. Pl. Pt. 1: 154 (1883); Hultén, Fl. Alaska & Yuk. Pt. 5: 920 (1945); Porsild in Nat. Mus. Can. Bull. **101:** 22 (1945).

Bolstead Cr., Canol Rd., mi. 111 E., alpine slopes up to alt. 7000′, *Wynne-Edwards 8328, 8329* (Can.).

Noted in Fl. Bor.-Am. as occurring "From the Saskatchewan to the Arctic Seashore. . . ." I have seen a specimen from Great Bear L., but the species has not been reported in the Athabaska–Great Slave L. region.

**Saxifraga flagellaris** Willd. ex Sternb. Rev. Saxifr. 25, *t. 6* (1810); Hultén, Fl. Alaska & Yuk. Pt. 5: 915 (1945); Porsild in Nat. Mus. Can. Bull. **101:** 22 (1945).

Bolstead Cr., Canol Rd., mi. 111 E., alpine slopes up to alt. 7000′, *Wynne-Edwards 8330, 8331* (Can.).

**Saxifraga oppositifolia** L. Sp. Pl. 402 (1753); Hultén, Fl. Alaska & Yuk. Pt. 5: 926 (1945); Porsild in Nat. Mus. Can. Bull. **101: 22, 31** (1945).

Liard R. between Nahanni Butte and Simpson, *Crickmay 57* (Can.); alpine meadows, shale cliffs and rock-slides, north slope of Colonel Mt., *9397, 9623;* Lone Mt., *Wynne-Edwards 8481* (Can.); Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11813* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8332* (Can.).

In the Brintnell L. area this species is common on Colonel Mt. but was not observed elsewhere; found with flowers and immature capsules early in July, and with ripe fruit late in July.

**Heuchera Richardsonii** R. Br. in Richardson, Bot. App. Frankl. Journ. 766, *t. 29* (1823); Hooker, Fl. Bor.-Am. **1:** 237 (1834); Raup in Jour. Arn. Arb. **17:** 262 (1936). See Rosendahl, Butters, & Lakela in Rhod. **35:** 111–118 (1933).

*Heuchera hispida* sensu Macoun, Cat. Can. Pl. Pt. 1: 158 (1883), non Pursh.

Providence, *Dutilly 74* (G).

Common in the Wood Buffalo Park and probably so along the upper Mackenzie. Noted in Fl. Bor.-Am. on "Dry banks of Rivers, from lat. 54° to 64° North."

**Mitella nuda** L. Sp. Pl. 406 (1753); Hooker, Fl. Bor.-Am. **1:** 240 (1834); Macoun, Cat. Can. Pl. Pt. 1: 157 (1883); Raup in Jour. Arn. Arb. **17:** 262 (1936); Hultén, Fl. Alaska & Yuk. Pt. 5: 947 (1945).

Fort Smith, *Miss E. Taylor 21* (G, Can.); Simpson, *Hardisty & McFarlane* (N); same, *Onion, Kennicott & Hardisty* (N); damp mossy lowland woods near Simpson, *9099.*

Common in the Simpson area, and probably also in rich woods throughout the river lowlands. In flower about mid-June. Noted in Fl. Bor.-Am. "From Lake Huron to the shores of the Arctic Sea. . . ."

**Chrysosplenium tetrandrum** (Lund) Th. Fries, in Bot. Notiser **1858:** 193 (1858); Raup in Jour. Arn. Arb. **17:** 262 (1936); Hultén, Fl. Alaska & Yuk. Pt. 5: 949 (1945); Porsild in Nat. Mus. Can. Bull. **101:** 22 (1945).

*Chrysosplenium alterniflorum* sensu Hooker, Fl. Bor.-Am. **1:** 241 (1834); Macoun, Cat. Can. Pl. Pt. 1: 159 (1883); non L.

Thickets in wet muskeg at west end of Brintnell L., *9241;* stony beach on shore of Brintnell L. at Camp Pt., *9160.*

Common in the muskeg habitat; capsules mature in the latter part of June. Noted by Porsild as occasional or rare in Macmillan Pass. In Fl. Bor.-Am. it is said to occur "In the woody, but principally the barren country of British North America."

**Parnassia fimbriata** Koenig in Ann. Bot. **1:** 391 (1804); Hultén, Fl. Alaska & Yuk. Pt. 5: 952 (1945); Porsild in Nat. Mus. Can. Bull. **101:** 22 (1945).

Alpine meadow along small brook on west slope of Terrace Mt., alt. 5000′, *9553;* alpine meadows in Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11238* (Can.).

Noted by Porsild as common in Macmillan Pass; but at Brintnell L. it was found in only one place. In flower about mid-July.

**Parnassia palustris** L. var. **neogaea** Fernald in Rhod. **39:** 311 (1937); Hultén, Fl. Alaska & Yuk. 5: 956 (1945); Porsild in Nat. Mus. Can. Bull. **101:** 22, 31, 35 (1945).

*Parnassia palustris* L. sensu Hooker, Fl. Bor.-Am. **1:** 82 (1830), in part; Macoun, Cat. Can. Pl. Pt. 1: 159 (1883).

*Parnassia multiseta* sensu Fernald in Rhod. **28:** 211 (1926), non *P. palustris* var. *multiseta* Ledeb.; Raup in Jour. Arn. Arb. **17:** 262 (1936).

Slave R., *Miss E. Taylor 25* (G); Little Buffalo R., *Russell 77* (G); Great Slave L., *R. Bell 23164* (Can.); southwest and north shores of Great Slave L., *Howe 91969* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); east shore of Trout L., *C. O. Hage* (G); Mackenzie R., *Kennicott* (N); Liard R. between Nahanni Butte and Simpson, *Crickmay 55* (Can.); Mackenzie R., 5 mi. above old Ft. Norman, *Wynne-Edwards 8562* (Can.); thickets in upland woods west of Mackenzie R. near Simpson, *9916;* muskeg thickets along north shore of Brintnell L., *9344, 9571;* gravelly thickets near west end of Brintnell L., *9440;* Lone Mt., *Wynne-Edwards 8484* (Can.).

Common at Brintnell L. and Simpson, and noted by Porsild as common along a small tributary to Little Keele R., Canol Rd., mi. 51 E. In Fl. Bor.-Am. its range is given as extending ". . . as far north as the Arctic Circle. . . ."

**Parnassia montanensis** Fernald & Rydb. in N. Am. Fl. **22:** 79 (1905); Porsild in Nat. Mus. Can. Bull. **101:** 33 (1945).

South bank of Mackenzie R., 10 mi. below Mills L., *Wynne-Edwards 8552* (Can.).

This species is occasional in the Athabaska–Great Slave L. region. It is not included in Hultén's Fl. Alaska & Yuk., but was collected in the mountains of southwestern Yukon by Bakewell (Rhod. **45:** 311, 1943).

**Parnassia Kotzebuei** Cham. & Schl. in Linnaea **1:** 549 (1826); Hultén, Fl. Alaska & Yuk. Pt. 5: 953 (1945); Porsild in Nat. Mus. Can. Bull. **101:** 22 (1945).

Mossy banks and muskegs along north shore of Brintnell L., *9154, 9343;* Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8319* (Can.).

Occasional to common at Brintnell L., found flowering in late June and early July. Porsild notes it as common in Macmillan Pass.

**Ribes oxyacanthoides** L. Sp. Pl. 201 (1753); Preble in N. Am. Fauna **27:** 525 (1908); Raup in Jour. Arn. Arb. **17:** 263 (1936); Hultén, Fl. Alaska & Yuk. Pt. 5: 962 (1945).

Fort Smith, *Seton & Preble 78578* (Can.); lower Slave R., *Raup 854;* Resolution, *Kennicott* (N); same place, *Preble 205* (US); Hay River, *Preble & Cary 26* (US); east shore of Trout L., *C. O. Hage* (G); Simpson, *Preble 300, 309* (US); damp woods near Simpson, shrubs up to 3′ high, *9081;* open woods and thickets on gravel plain west of Brintnell L., shrub 2′ high, *9806.*

Common in the lowlands, and only occasional at Brintnell L.; in flower at Simpson about mid-June, and in fruit at Brintnell L. in mid-August. Preble states that it "is the commonest representative of the genus throughout the region. . . ." He noted it at Great Bear L.

**Ribes hudsonianum** Richardson, Bot. App. Frankl. Journ. ed. 2: 6 (1824); Preble in N. Am. Fauna **27:** 526 (1908); Raup in Jour. Arn. Arb. **17:** 263 (1936); Porsild in Sargentia **4:** 49 (1943); Hultén, Fl. Alaska & Yuk. Pt. 5: 959 (1945).

Fort Smith, *Miss E. Taylor* (G, Can.); same place, *Seton & Preble 78326* (Can.); Resolution, *Onion, Kennicott & Hardisty* (N); southwest shore of Great Slave L., *Brooke* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); east shore of Trout L., *C. O. Hage* (G); Mackenzie R., *Kennicott* (N); Liard R. between Nahanni Butte and Simpson, *Crickmay 56* (Can.); damp woods at Simpson, shrubs 3′ high, *9078;* mossy woods along shore of Brintnell L. near camp, shrubs up to 3′ high, *9189, 9598.*

Common to abundant, particularly at the edge of woods or in open spaces; in flower about mid-June and in fruit in the latter part of July. Richardson noted it only as far north as lat. 57°, but Preble reports it at ". . . various places from the Athabaska nearly to Great Bear Lake." Porsild collected it in the Mackenzie delta, and states that it is common at Great Bear L.

**Ribes lacustre** (Pers.) Poir. in Lam. Encycl. Méth. Suppl. **2:** 856 (1812); Hooker, Fl. Bor.-Am. **1:** 232 (1834); Macoun, Cat. Can. Pl. Pt. 1: 161 (1883); Porsild in Sargentia **4:** 48 (1943); Hultén, Fl. Alaska & Yuk. Pt. 5: 960 (1945).

*Ribes oxyacanthoides* var. *lacustris* Pers. Syn. Pl. **1:** 252 (1805).

Damp lowland woods near Simpson, decumbent shrub trailing in moss, *9077;* open woods and thickets on gravel plain at west end of Brintnell L., low shrub, *9807.*

Occasional; in flower at Simpson about mid-June, and with mature fruit in the mountains about mid-August. Hooker gives the northern range of this species as "Throughout Canada to Fort Franklin and Bear Lake, near the Arctic circle." Porsild, however, maintains that the Fl. Bor.-Am. record for Great Bear L. is *R. oxyacanthoides,* but he reports *R. lacustre* at Gordon L. on the Yellowknife R. Preble apparently did not see *R. lacustre* anywhere in the Mackenzie basin.

**Ribes glandulosum** Grauer, Pl. Min. Cog. 2 (1784); Raup in Jour. Arn. Arb. **17:** 263 (1936).

*Ribes prostratum* L'Her.; Preble in N. Am. Fauna **27:** 526 (1908); Hultén, Fl. Alaska & Yuk. Pt. 5: 962 (1945).

Slave R., *Miss E. Taylor 8666* (Can.); Resolution, *Kennicott* (N); mossy woods on shore of Brintnell L. near camp, decumbent shrub, *9182, 9601.*

Common in the Brintnell L. habitat; collected in flower June 20, and with mature fruit July 26. Noted by Preble as occurring ". . . throughout the country from the Athabaska north at least to Great Bear Lake."

**Ribes triste** Pall. in Nova Acta Acad. Petrop. **10:** 378 (1797); Raup in Jour. Arn. Arb. **17:** 263 (1936); Hultén, Fl. Alaska & Yuk. Pt. 5: 963 (1945).

*Ribes rubrum* sensu Hooker, Fl. Bor.-Am. **1:** 232 (1834); Macoun, Cat. Can. Pl. Pt. 1: 162 (1883); Preble in N. Am. Fl. **27:** 526 (1908); non L.

Fort Smith, *Seton & Preble 78328* (Can.); Mackenzie R., *Onion* (N); near Wrigley, *Miss E. Taylor 125* (Can.); rich woods on shore of Brintnell L., near camp, low shrubs up to 2′ high, *9188, 9488.*

Common in the Brintnell L. habitat; collected with late flowers and immature fruit June 20, and with ripe berries in mid-July. Noted in Fl. Bor.-Am. ". . . to the mouth of the Mackenzie River;" and by Preble, ". . . throughout the region north at least to Great Bear Lake." I have seen specimens from the lower Mackenzie collected by *Kennicott* (N) and *McConnell* (Can.).

## ROSACEAE

**Spiraea Beauverdiana** Schn. in Bull. Herb. Boiss. II. **5:** 348 (1905); Porsild in Nat. Mus. Can. Bull. **101:** 23 (1945). See also Porsild in Rhod. **41:** 244 (1939), and in Sargentia **4:** 48 (1943).

Mackenzie R. between Blackwater R. and Norman, *Crickmay 169* (Can.).

This species was noted by Porsild as very common in Macmillan Pass, along the Canol Rd., mi. 225 E.

**Amelanchier florida** Lindl. in Bot. Reg. *t. 1589* (1833); Raup in Jour. Arn. Arb. **17:** 264 (1936).

*Amelanchier ovalis* sensu Hooker, Fl. Bor.-Am. **1:** 202 (1834), in part, non Willd.

*Amelanchier alnifolia* sensu Preble in N. Am. Fauna **27:** 528 (1908), ? non Nutt.

*"Amelanchier canadensis* var. *(?) oblongifolia"* sensu Macoun, Cat. Can. Pl. Pt. 1: 149 (1883), in part, non T. & G.

Fort Smith, *Raup 930;* same place, *Seton & Preble 78587* (Can.); Resolution, *Kennicott* (N); along road in upland woods west of Mackenzie R. near Simpson, *9906;* south slope of Red Mt., near timber line, shrub 2′–3′ high, *9222.*

Occasional to common near Simpson, but aparently rare in the Mountains; in flower at Brintnell L. June 21. Part of the records for *A. ovalis* in Fl. Bor.-Am., ". . . to the Saskatchewan and Mackenzie Rivers" probably refers to this species, as does also Preble's note that it occurs ". . . northward to the limit of the woods." Porsild (Sargentia **4**: 48) regards the *Amelanchier* of Great Bear L. and the lower Mackenzie as *A. sanguinea* (Pursh) DC.

Our Simpson and Brintnell L. plants approach the *A. humilis* described by Wiegand in Rhod. **14**: 141 (1912), but there appears to be considerable doubt whether this species is separable from the widespread *A. florida* of the northwest.

**Rubus strigosus** Michx. Fl. Bor.-Am. **1**: 297 (1803); Preble in N. Am. Fauna **27**: 527 (1908). See L. H. Bailey in Gentes Herb. **5**: 861–878 (1945).

*Rubus idaeus* L. var. *canadensis* Richardson ex Fernald in Rhod. **21**: 89–98 (1919); Raup in Jour. Arn. Arb. **17**: 264 (1936), in part.

*Rubus idaeus* L. var. *strigosus* (Michx.) Maxim.; Fernald, l. c.; Raup in Jour. Arn. Arb. **17**: 265 (1936), in part.

Fort Smith, *Raup 885;* lower Slave R., *Raup 882;* Rae, *Russell* (Can.); east shore of Trout L., *C. O. Hage* (G); small sandy clearing near eastern end of Brintnell L., shrubs *2′* high, *9350.*

Occasional to common in gravelly or sandy thickets around the shore of Brintnell L., and observed at about 4000′ on the warm southerly slope of Terrace Mt.; in flower early in July. This species is common to abundant in the Athabaska–Great Slave Lake region, and it is strange that in Hooker's Fl. Bor.-Am. it is not noted north of the Saskatchewan. Preble gives its range as ". . . nearly throughout the forested region." I have seen specimens of it from the lower Mackenzie (Good Hope, *Onion,* N; Peel R., *Miss E. Taylor,* Can.). Bailey, in his recent revision of the American representatives of *R. idaeus,* does not recognize the two entities that were defined by Fernald as *R. idaeus* var. *canadensis* and *R. idaeus* var. *strigosus.* In the former the primocanes are invested with a fine pubescence beneath the prickles, while in the latter the stems are smooth beneath the armature. In the Mackenzie basin "var. *canadensis*" is by far the most abundant, though "var. *strigosus*" is actually widespread within the same area. In the east, however, the former is somewhat more northern in its range, and should perhaps be kept separate.

**Rubus Chamaemorus** L. Sp. Pl. 494 (1753); Hooker, Fl. Bor.-Am. **1**: 183 (1834); Macoun, Cat. Can. Pl. Pt. 1: 128 (1883); Preble in N. Am. Fauna **27**: 526 (1908); Raup in Jour. Arn. Arb. **17**: 265 (1936).

Resolution, *Kennicott* (N); same place, *Miss E. Taylor* (G, N, Can.); southwest and north shores of Great Slave L., *Howe 91975* (Can.); mouth of Little Buffalo R., *Brooke* (Can.); 12 mi. E. of Moraine Pt., Great Slave L., *Bedford* (Can.); near Rae, *Russell* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 59* (Can.); Willow Lake R., 44 mi. above mouth, *Crickway 19* (Can.); muskeg on south shore of Brintnell L., *9322.*

Common in muskegs; collected in flower at Brintnell L. the last of June. Noted by Hooker "From Lake Winipeg . . . to the shores of the Arctic Sea," and Preble gives it a similar range.

**Rubus pubescens** Raf. Med. Repos. **2**: 333 (1811); Raup in Jour. Arn. Arb. **17**: 265 (1936).

Slave R., 100 mi. below Ft. Smith, *Preble & Cary 14* (US); east shore of Trout L., *C. O. Hage* (G); Mackenzie R., *Kennicott* (N); Simpson, *Onion* (N); damp lowland woods at Simpson, *9094;* Willow Lake R., 44 mi. above mouth, *Crickmay 15* (Can.).

Common northward at least as far as Simpson, and collected in the Mackenzie delta by Porsild (Sargentia **4**: 48). In flower in late May and the first half of June.

**Rubus acaulis** Michx. Fl. Bor.-Am. **1**: 298 (1803); Hooker, Fl. Bor.-Am. **1**: 182 (1834); Raup in Jour. Arn. Arb. **17**: 265 (1936); Porsild in Nat. Mus. Can. Bull. **101**: 23 (1945).

*Rubus arcticus* L. var. *grandiflorus* sensu Macoun, Cat. Can. Pl. Pt. 1: 129 (1883), non Ledeb.

*Rubus arcticus* sensu Preble in N. Am. Fauna **27**: 526 (1908), non L.

Fort Smith, *Miss E. Taylor* (G, Can.); Little Buffalo R., *Russell 79* (G); lower Slave R., *Brooke* (Can.); Resolution, *Kennicott* (N); Hay River, *Preble & Cary 20* (US); southwest and north shores of Great Slave L., *Howe 91974* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 60* (Can.); Simpson, *Kennicott* (N); same, *Onion* (N); damp place in lowland woods near Simpson, *9106;* Willow Lake R., 44 mi. above mouth, *Crickmay 18* (Can.); damp moss in woods on shore of Brintnell L., *9179;* Nahanni Mts., *Preble & Cary 60* (US).

Common; in flower about mid-June. Porsild notes it as common in Macmillan Pass, along the Canol Rd. Its range is given in Fl. Bor.-Am., "From the Saskatchewan. . . to Fort Franklin. . . ." Preble states that it has about the same range as *R. Chamaemorus* in the Mackenzie basin.

I have seen a specimen from Hay River, on the southwest shore of Great Slave L. (*Preble & Cary 25,* US), which appears to be intermediate between *R. pubescens* and *R. acaulis.* This form has been observed before, and is regarded by some students as a hybrid. L. H. Bailey, however, has described such an intermediate from central Saskatchewan and Alberta as *R. paracaulis* (Gent. Herb. **5**: 33, 1941). The status of the Hay River plant must remain uncertain until further material is available.

**Fragaria glauca** (Wats.) Rydb. Mem. Dept. Bot. Columbia Univ. **2**: 183 (1898); Raup in Jour. Arn. Arb. **17**: 266 (1936).

*Fragaria virginiana* Duchesne *? glauca* Wats. Bot. King's Expl. 85 (1871).

*Fragaria virginiana* sensu Hooker, Fl. Bor.-Am. **1**: 184 (1834), in part; Macoun, Cat. Can. Pl. Pt. 1: 135 (1883), in part; non Duchesne.

*Fragaria canadensis* sensu Hooker, Fl. Bor.-Am. **1**: 185 (1834), in part, non Michx.

*Fragaria pauciflora* Rydb. in Mem. Dept. Bot. Columbia Univ. **2**: 183 (1898), at least in part.

Forth Smith, *Raup 969;* same place, *Miss E. Taylor 7169* (Can.); same place, *Seton & Preble 78574* (Can.); Little Buffalo R., *Russell 37* (G); east shore of Trout L., *C. O. Hage* (G); Simpson, *Onion* (N); old field at Simpson, *9128;* damp thickets near west end of Brintnell L., *9437.*

Occasional to common; found flowering at Simpson about mid-June, and at Brintnell L. early in July. Noted in Fl. Bor.-Am. in the "Woody country between lat. 52° and 64°." Our no. *9437* is referred to *F. glauca* with some question, for it has unusually narrow, obovate-cuneate leaflets (some of them 5:2 cm.). This tendency can be seen in occasional specimens throughout the range of the species, but in our plants nearly all of the leaves show it.

**Fragaria vesca** L. var. **americana** Porter in Bull. Torr. Bot. Cl. **17**: 15 (1890).

Resolution, *Preble 208, 209* (US); along road in damp lowland woods near Simpson, *9087.*

Occasional; found in flower June 11.

**Potentilla arguta** Pursh, Fl. Am. Sept. 736 (1814); Hooker, Fl. Bor.-Am. **1**: 186 (1834); Macoun, Cat. Can. Pl. Pt. 1: 136 (1883); Raup in Jour. Arn. Arb. **17**: 266 (1936).

*Drymocallis agrimonioides* (Pursh) Rydb. in N. Am. Fl. **22**: 368 (1908).

This species has not been collected in recent years north of the Wood Buffalo Park, where it is common in dry prairies and rock crevices. Hooker gives its range in Fl. Bor.-Am. as "Woody country as far as lat. 65°, north. . . ." Rydberg states that it extends to Simpson.

**Potentilla norvegica** L. Sp. Pl. 499 (1753); Hooker, Fl. Bor.-Am. **1**: 193 (1834); Macoun, Cat. Can. Pl. Pt. 1: 136 (1883); Raup in Jour. Arn. Arb. **17**: 266 (1936).

Fort Smith, *Raup 966;* Resolution, *Preble 214* (US); southwest and north shores of Great Slave L., *Howe 91973* (Can.); east shore of Trout L., *C. O. Hage* (G); Providence, *Dutilly 68* (G); Liard R. between Nahanni Butte and Simpson, *Crickmay 62* (Can.); damp place in open field at Simpson, *9851;* along dry watercourse on south-facing slope of granite mountain west of Brintnell L., *9478.*

Apparently rather common in the low country, but rare or occasional at Brintnell L.; in flower about mid-July. Noted in Fl. Bor.-Am. as occurring "Throughout Canada; as far north as the Bear Lake."

**Potentilla diversifolia** Lehm. var. **glaucophylla** (Lehm.) Lehm. Stirp. Pug. **9**: 44 (1851); Porsild in Nat. Mus. Can. Bull. **101**: 23 (1945).

*Potentilla glaucophylla* Lehm. Delect. Sem. Hort. Bot. Hamb. **1836**: 7 (1836).

Liard R. between Nahanni Butte and Simpson, *Crickmay 66* (Can.); alpine meadows and turfy shale slopes, south side of Red Mt., alt. about 5000′, *9208, 9724;* along small brook on west slope of Terrace Mt., alt. 4800′–5000′, *9545;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11245, 11246* (Can.).

Common on south- and west-facing slopes above Brintnell L., but not seen elsewhere in that area; collected in flower in late June and mid-July. Porsild reports it as common in Macmillan Pass.

**Potentilla emarginata** Pursh, Fl. Am. Sept. 353 (1814); Porsild in Nat. Mus. Can. Bull. **101**: 23 (1945).

High alpine rock crevices, east slopes of Red Mt., alt. 5500′–5900′, *9293, 9726;* shale slopes on west side of Terrace Mt., alt. 5000′–6000′, *9520;* Bolstead Cr., Canol Rd., mi. 111 E., alpine ridge, alt. 6000′, *Wynne-Edwards 8337* (Can.).

Apparently rare or occasional in the Brintnell L. area; in flower late in June, and with maturing achenes by mid-July.

**Potentilla nivea** L. Sp. Pl. 499 (1753); Hooker, Fl. Bor.-Am. **1**: 195 (1834); Macoun, Cat. Can. Pl. Pt. 1: 139 (1883); Raup in Jour. Arn. Arb. **17**: 267 (1936).

Liard R. between Nahanni Butte and Simpson, *Crickmay 64* (Can.); alpine meadows and loose shale, south slope of Red Mt., alt. 5500′, *9209, 9757;* shale cliffs on south slope of Terrace Mt., alt. 5000′, *9682;* Nahanni Mts., *Preble 314* (US).

Common locally, but not widely distributed at Brintnell L.; observed only on south-facing slopes. In flower in the latter part of June. Noted in Fl. Bor.-Am. ". . . to the shores of the Arctic Sea." Most of the specimens cited above appear to represent var. *subquinata* Lange (Consp. Fl. Groenl. 9, 1880) (= *P. nipharga* Rydb. in N. Am. Fl. **22**: 332, 1908).

**Potentilla biflora** Willd. in Schlecht. Ges. Nat. Freunde Berlin Mag. **7**: 297 (1815); Porsild in Nat. Mus. Can. Bull. **101**: 23 (1945).

Plains of Abraham, Canol Rd., mi. 82 E., on rocky slope with *Cassiope tetragona,* alt. 6000′, *Porsild 11814* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., on alpine ridge, alt. 5500′, *Wynne-Edwards 8339, 8340* (Can.).

**Potentilla elegans** Cham. & Schl. in Linnaea **2:** *22* (1827); Porsild in Nat. Mus. Can. Bull. **101:** *23* (1945).

Alpine rocky slopes south of Little Keele R., Canol Rd., mi. 55 E., alt. 4000′, *Porsild 11786* (Can.).

**Potentilla uniflora** Ledeb. in Mém. Acad. St. Pétersb. **5:** 543 (1812); Porsild in Nat. Mus. Can. Bull. **101:** *23* (1945).

Liard R. between Nahanni Butte and Simpson, *Crickmay 67* (Can.); shale cliffs and slide rock, south slope of Red Mt., alt. 5500′, *9753;* Lone Mt., *Wynne-Edwards 8486* (Can.); Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11815* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8338* (Can.).

Common at the site of the single Brintnell L. collection, but not seen elsewhere in that area; found with maturing achenes and a few late flowers Aug. 7.

**Potentilla multifida** L. Sp. Pl. 496 (1753); Raup in Jour. Arn. Arb. **17:** *267* (1936).

Fort Smith, *Seton & Preble* (N, Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 68* (Can.); roadways and dooryards at Simpson, *9142;* Norman, *Dutilly 55* (G).

A common weed at Simpson; found with a few early flowers in mid-June. I have seen a specimen also from Good Hope ( *Miss E. Taylor,* Can.).

**Potentilla pennsylvanica** L. Mant. 76 (1767); Hooker, Fl. Bor.-Am. **1:** 187 (1834); Macoun, Cat. Can. Pl. Pt. 1: 136 (1883); Raup in Jour. Arn. Arb. **17:** *267* (1936).

Resolution, *Onion, Kennicott & Hardisty* (N); dry bank in open field at Simpson, *9850.*

Common in this habitat at Simpson; achenes mature in late August. Noted in Fl. Bor.-Am. as occurring "About the Saskatchewan, and as far north as the Bear Lake. . . ." Porsild (Sargentia **4:** 48) has collected it in the Richardson Mts. and in the Eskimo Lakes basin.

**Potentilla pectinata** Raf. Aut. Bot. 164 (1840); Raup in Jour. Arn. Arb. **17:** 268 (1936); Porsild in Sargentia **4:** 48 (1943).

Liard R. between Nahanni Butte and Simpson, *Crickmay 69* (Can.).

This species is apparently widespread in the Mackenzie basin, though scattered. It has been found at a few places in the Athabaska–Great Slave L. region, and Porsild has reported a plant from the arctic coast which closely resembles it.

**Potentilla Anserina** L. Sp. Pl. 495 (1753); Hooker, Fl. Bor.-Am. **1:** 189 (1834); Macoun, Cat. Can. Pl. Pt. 1: **141** (1883); Raup in Jour. Arn. Arb. **17:** *268* (1936). See Fernald in Rhod. **35:** *273* (1933).

Fort Smith, *Raup 943;* along the Nyarling R., *Russell 52* (G); Resolution, *Miss E. Taylor 100931* (Can.); Hay River, *Hume 102668* (Can.); same place, *Preble & Cary 23* (US); Liard R. between Nahanni Butte and Simpson, *Crickmay 63* (Can.); Simpson, *Onion* (N); same, *Onion, Kennicott & Hardisty* (N); cleared ground at Simpson, *9116;* Mackenzie R. near Wrigley, *Miss E. Taylor 98* (Can.) and *34* (G); Willow Lake R., 44 mi. above mouth, *Crickmay 5* (Can.).

An abundant weed in villages; in flower about mid-June. Noted in Fl. Bor.-Am. from "Lake Huron to the extreme Arctic regions. . . ." Forma *sericea* (Hayne) Fernald (1. c.) is of common occurrence with the typical species.

**Potentilla palustris** (L.) Scop. Fl. Carn. ed. *2,* **1:** 359 (1772); Hooker, Fl. Bor.-Am. **1:** 187 (1834); Macoun, Cat. Can. Pl. Pt. 1: 140 (1883); Raup in Jour. Arn. Arb. **17:** *268* (1936); Porsild in Nat. Mus. Can. Bull. **101:** *23* (1945).

*Comarum palustre* L. Sp. Pl. 502 (1753).

Rae, *Russell* (Can.); noted by Porsild in ponds in Macmillan Pass along the Canol Rd., mi. 225 E.

Hooker gives the range of this species as extending ". . . as far north as Bear Lake." There are two specimens in Herb. N. collected by *Onion, Kennicott*

*& Hardisty* without locality data, but they probably came from the upper Mackenzie. I have seen a specimen from Great Bear L. (*J. M. Bell,* Can.).

**Potentilla fruticosa** L. Sp. Pl. 495 (1753); Hooker, Fl. Bor.-Am. **1:** 186 (1834); Macoun, Cat. Can. Pl. Pt. 1: 141 (1883); Raup in Jour. Arn. Arb. **17:** 268 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 23, 31 (1945).

*Dasiphora fruticosa* (L.) Rydb.; Preble in N. Am. Fauna **27:** 527 (1908).

Fort Smith, *Raup 961;* Little Buffalo R., *Russell 88* (G); southwest and north shores of Great Slave L., *Howe 91972* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Rae, *Russell* (Can.); Great Slave L., *R. Bell 23158* (Can.); same, *Kennicott* (N); east shore of Trout L., *C. O. Hage* (G); Providence, *Preble & Cary 35, 49* (US); Mackenzie R., *Kennicott* (N); Liard R. between Nahanni Butte and Simpson, *Crickmay 65* (Can.); Wrigley, *Miss E. Taylor 32* (N), *41* (G); muskeg thickets at west end of Brintnell L., *9251;* woods on shore of Brintnell L. near Camp Pt., *9183;* rocky south and east slopes of Red Mt., in scrub timber and near summit, *9213, 9727;* north peak of Nahanni Mt., *Wynne-Edwards 8485* (Can.).

Common throughout the region; found flowering from late June to mid-August. Preble gives its range as ". . . throughout the region north to the limit of the forest." I have seen specimens from Great Bear L. (*J. M. Bell,* Can.) and the lower Mackenzie (*Onion,* N). Porsild reports the species common all along the Canol Rd.

**Potentilla tridentata** Ait. Hort. Kew. **2:** 216 (1789); Hooker, Fl. Bor.-Am. **1:** 195 (1834); Macoun, Cat. Can. Pl. Pt. 1: 141 (1883); Raup in Jour. Arn. Arb. **17:** 268 (1936).

This species has not been collected in recent years northward of Lake Athabaska and the Wood Buffalo Park, but in Fl. Bor.-Am. its range is noted as follows: ". . . Canada, and throughout the woody country, from Lake Huron . . . as far as lat. 64°." There is a Richardson specimen in Herb. N., but it is without locality data.

**Sibbaldia procumbens** L. Sp. Pl. 284 (1753); Porsild in Sargentia **4:** 49 (1943), in Nat. Mus. Can. Bull. **101:** 23 (1945).

Thickets on stony beach at Camp Pt., Brintnell L., *9169;* along small brook on east slope of Red Mt., alt. 4500′, *9271.*

Occasional to common in the Brintnell L. area, and noted by Porsild as very common in Macmillan Pass along the Canol Rd. Found with maturing achenes at low elevations on June 20, and with flowers higher in the mountains late in June.

**Geum macrophyllum** Willd. var. **perincisum** (Rydb.) Raup in Rhod. **33:** 176 (1931), in Jour. Arn. Arb. **17:** 269 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 23 (1945).

*Geum perincisum* Rydb. in N. Am. Fl. **22:** 405 (1913).

*Geum oregonense* sensu Rydb. in op. cit. 404, non Scheutz.

Fort Smith, *Raup 922, 925, 926;* lower Slave R., *Raup 924;* Mackenzie R., *Onion, Kennicott & Hardisty* (N); Simpson, *Onion, Kennicott & Hardisty* (N); upland prairie west of the Mackenzie R. near Simpson, *9890;* gravelly and marshy thickets on south shore of Brintnell L., *9331, 9493;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11241* (Can.).

Common at the Simpson and Brintnell L. stations; in flower at the latter place the last of June.

**Geum aleppicum** Jacq. var. **strictum** (Ait.) Fernald in Rhod. **37:** 294 (1935).

*Geum strictum* Ait. Hort. Kew. **1:** 217 (1789); Raup in Jour. Arn. Arb. **17:** 269 (1936).

Simpson, *Miss E. Taylor 122* (Can.); damp thickets at Simpson, *9845.*

Common at Simpson; in fruit in the latter part of August. This appears to be a northwestern extension of the range of this species. It is occasional in the Wood Buffalo Park and southward.

**Dryas Drummondii** Richardson in Hook. Bot. Mag. *pl. 2972* (1830); Hooker, Fl. Bor.-Am. **1:** 174 (1834); Macoun, Cat. Can. Pl. Pt. 1: 132 (1883); Preble in N. Am. Fauna **27:** 528 (1908); Raup in Jour. Arn. Arb. **17:** 269 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 23, 31, 33 (1945).

Resolution, *Kennicott* (N); Jones Pt., Great Slave L., *Hume 102669* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Simpson, *Onion* (N); outwash plain near mouth of North Nahanni R., *Wynne-Edwards 8537* (Can.); gravel plains in low ground near west end of Brintnell L., *9443;* rock-slides on north slope of Colonel Mt., alt. 5000′, *9631;* Lone Mt., *Wynne-Edwards 8487* (Can.); Nahanni Mts., *Preble & Cary 79* (US); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11868* (Can.).

Common to abundant on the low gravel plains at Brintnell L., where it forms broad mats to the exclusion of nearly all other species; only occasional on high mountain slopes; in flower early in July. Noted in Fl. Bor.-Am., "In the woody country between lat. 54° and 64°, and about Slave Lake and Bear Lake, as far as the mouth of the River Bear Lake on the shores of the Arctic Sea in lat. 68°;" and by Preble on the ". . . summit of the Nahanni Mountains. . . ."

**Dryas integrifolia** Vahl in Skr. Nat. Selsk. Kjøb. **4**[2]**:** 171 (1798); Hooker, Fl. Bor.-Am. **1:** 174 (1834); Macoun, Cat. Can. Pl. Pt. 1: 132 (1883); Preble in N. Am. Fauna **27:** 527 (1908); Raup in Jour. Arn. Arb. **17:** 269 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 23, 31 (1945).

Great Slave L., *R. Bell 23156* (Can.); southwest and north shores of Great Slave L., *Howe 91971* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 61* (Can.); Lone Mt., *Wynne-Edwards 8488, 8489* (Can.); on Cap Mt., 4000′ above Mackenzie R., *R. A. Brooke* (Can.); steep rocky slopes and gravel beaches, south shore of Brintnell L., *9324, 9342;* newly-formed mud-flats at west end of Brintnell L., *9811;* rock-slides on north slope of Colonel Mt., alt. 5000′, *9628;* Bolstead Cr., Canol Rd., mi. 111 E., on alpine ridge, alt. 5000′–5500′, *Wynne-Edwards 8336* (Can.); Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11816* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11869, 11870* (Can.).

One of the most abundant and characteristic species of high alpine slide rock, upon which it exerts a stabilizing influence by the formation of dense mats. Though generally distributed over all the mountains of the Brintnell L. area, it appeared most abundant on the north slope of Colonel Mt. and the steep cliffs on the northeast side of Red Mt. It is also abundant on cliffs and ledges on the lower timbered slopes of Colonel Mt. On parts of the newly-formed mud-flats at the mouth of the glacial stream it forms dense broad mats. In flower in late June or early July. Porsild reports it common in many places along the Canol Rd., and it is noted in Fl. Bor.-Am. as occurring "In dry rocky places from lat. 54° to the shores and islands of the Arctic Sea. . . ." Preble states that at the level of the Mackenzie River he first saw it, on his way upstream, at Good Hope.

**Dryas octopetala** L. Sp. Pl. 501 (1753); Porsild in Nat. Mus. Can. Bull. **101:** 23 (1945).

Meadows and shaly slopes, south side of Red Mt., alt. 5000′–5500′, *9211, 9750;* high shale rock-slides on west slope of Terrace Mt., alt. 6000′, *9556;* Bolstead Cr., Canol Rd., mi. 111 E., alpine slope, *Wynne-Edwards 8334* (Can.).

An abundant primary species on some high-alpine, semi-stabilized slide rock at Brintnell L., particularly in the mountains north of the lake, where it appears to supersede *D. integrifolia.* It was not observed below timber line, and was collected in full flower June 21.

Forms intermediate between *D. octopetala* and *D. integrifolia* are common. They have been variously designated by different authors. Polunin regards those he saw in the eastern Arctic as *D. integrifolia* f. *intermedia* (Nath.) Polunin, while Porsild states that one of his numbers cited under *D. integrifolia* (*11870*) is the var. *intermedia* Nath. of that species. Still another view is that of Hartz, who makes *integrifolia* a subspecies of *D. octopetala,* and *intermedia* a form of the subspecies. Rydberg, in N. Am. Fl. **22**: 400, considered all the intermediates simply as hybrids of *D. octopetala* and *D. integrifolia,* and did not give them a separate name. Among our Brintnell Lake numbers *9556* and *9211* show some intermediate characters.

**Rosa acicularis** Lindl. Ros. Monogr. 44 (1820); Preble in N. Am. Fauna **27**: 528 (1908); Raup in Jour. Arn. Arb. **17**: 270 (1936).

*Rosa majalis* sensu Borrer in Hooker, Fl. Bor.-Am. **1**: 200 (1834), at least in part, non Herrm.

Fort Smith, *Seton & Preble 78325* (Can.); same place, *Raup 901;* Resolution, *Preble 223* (US); 12 mi. E. of Moraine Pt., Great Slave L., *Bedford* (Can.); near Rae, *Russell* (Can.); east shore of Trout L., *C. O. Hage* (G); Mackenzie R., *Richardson* (G); Providence, *Preble & Cary 29* (US); Simpson, *Onion, Kennicott & Hardisty* (N); Wrigley, *Miss E. Taylor 69* (Can.); Willow Lake R. at main Forks, 50 mi. above mouth, *Crickmay 23* (Can.); Nahanni Mts., *Preble & Cary 58* (US); mossy spruce woods on Camp Pt., Brintnell L., shrubs 1′–4′ high, *9304, 9812, 9813, 9814, 9816;* thickets on gravel plain near west end of Brintnell L., shrub 3′ high, *9808;* open spruce woods on rocky-sandy knoll near east end of Brintnell L., shrub 2′ high, *9583;* clearing in spruce woods along north shore of lake just east of Camp Pt., shrubs 1′–3′ high, *9817.*

Common to abundant throughout the forested parts of the region. At Brintnell L. it was observed as high as 4800′ on the warm southerly slopes of Red Mt. In flower late in June, and with maturing fruit about mid-August.

The wild roses of the Brintnell L. region proved to be extremely variable, especially in the shape of the ripened fruits. As soon as the latter began to mature, collections were made to illustrate as many forms as possible. All of them are quite clearly in the *acicularis* group, the variations of which have been studied with great care by Mrs. Erlanson (See Papers Mich. Acad. Sci. Arts & Lett. **5**: 77–94, 1925). The following excerpts from my field notes will illustrate the confusion in our material:

"In the mossy spruce woods west of the creek (Frost Creek, which enters the lake at Camp Pt.) the fruits are mostly elongate-elliptic or cylindric (no. *9812*), but occasionally one finds a spherical fruit." "East of the creek, in the mossy spruce woods at the margin of an old stream channel area, we found a form with distinctly pear-shaped hips (no. *9816*). Here also spherical fruits sometimes appear (no. *9814*). Along the lake east of camp is a shrubby clearing in the spruce woods. It is grown up to *Alnus crispa, Ribes triste, R. hudsonianum,* and *Rosa.* Practically all of the last have robust spherical fruits with scarcely any elongation (no. *9817*)."

It will be noted that in this small area (probably not over ¼ square mile), there appeared to be a certain amount of local segregation into groups with spherical, or with pyriform to cylindric or elliptic fruits. On one bush, however, no. *9813,* all of these forms were found! Using Mrs. Erlanson's suggested organization of the group, which involves also the glandularity and pubescence of the leaves, nos. *9814* and *9817* would represent var. *Bourgeauiana* Crépin, while nos. *9583, 9808, 9812, 9816* would fall into var. *lacorum* Erlanson (l. c.), or

possibly into typical *R. acicularis,* which has obovate fruits. Similar mixtures, even within small areas, have been noted by Mrs. Erlanson.

It should be mentioned that the forms with elongated fruits are much the most abundant in our region. They are also common in the Athabaska L. district (Raup, 1936, p. 270), where definitely cylindric fruits have been found. It is doubtful, however, if these variations can be maintained as varieties or subspecies in a geographic sense until more is known of their distribution.

Still another form in the *R. acicularis* group, described below, grows on another type of site in the Brintnell L. area, and appears to make no genetic contribution to the mixture noted above. At any rate nothing approaching the shape of its fruits is to be seen in the general mixture.

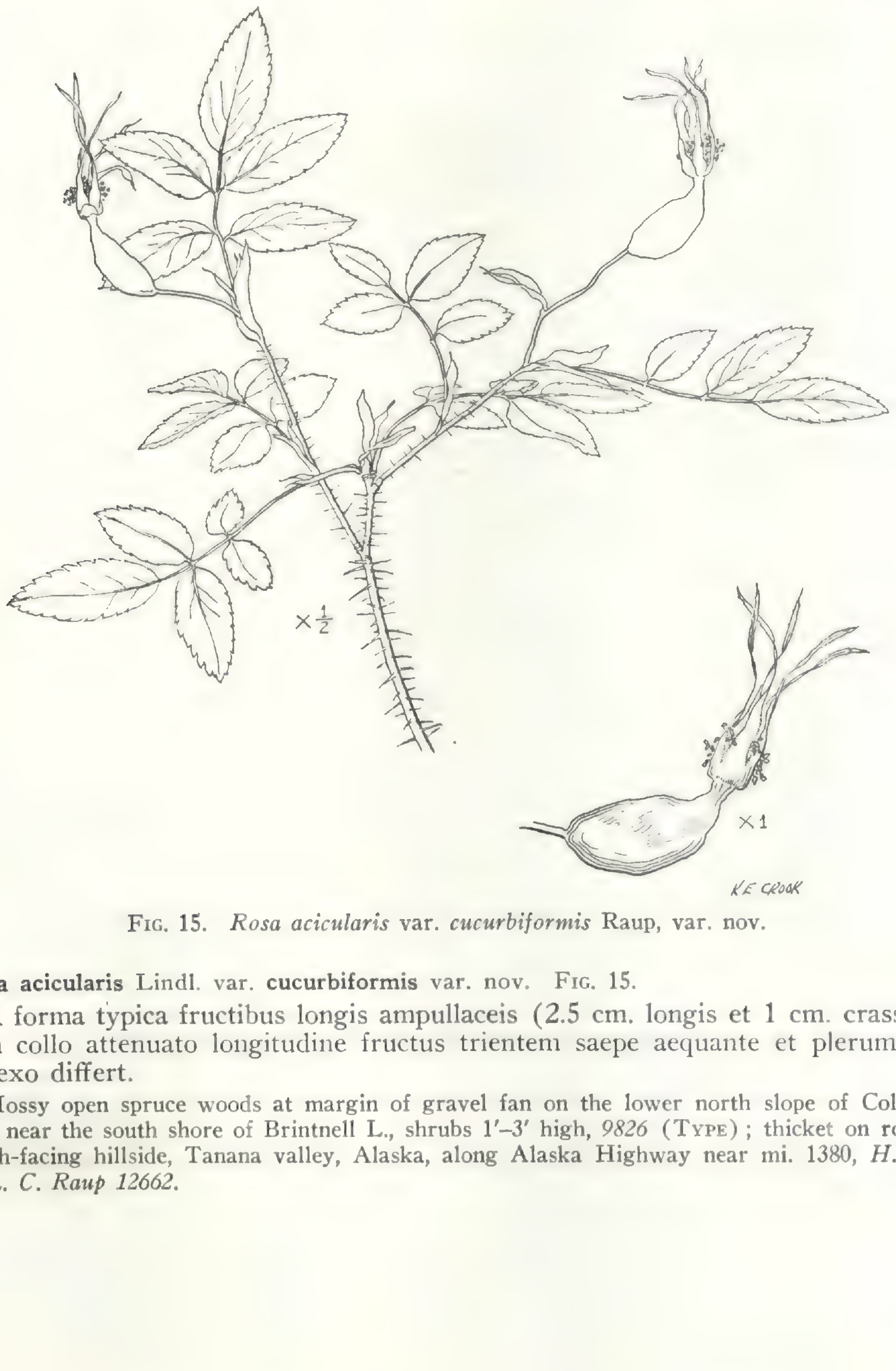


FIG. 15. *Rosa acicularis* var. *cucurbiformis* Raup, var. nov.

**Rosa acicularis** Lindl. var. **cucurbiformis** var. nov. FIG. 15.

A forma typica fructibus longis ampullaceis (2.5 cm. longis et 1 cm. crassis) cum collo attenuato longitudine fructus trientem saepe aequante et plerumque deflexo differt.

Mossy open spruce woods at margin of gravel fan on the lower north slope of Colonel Mt., near the south shore of Brintnell L., shrubs 1′–3′ high, *9826* (TYPE); thicket on rocky north-facing hillside, Tanana valley, Alaska, along Alaska Highway near mi. 1380, *H. M. & L. C. Raup 12662.*

Common at the Brintnell L. site, but not seen elsewhere except at the Alaska station above noted. Fruit maturing in mid-August.

In other characters these plants are clearly related to *R. acicularis* s. l. Their leaves have glandular serrate teeth and are glandular-granuliferous and somewhat pubescent beneath especially on the veins and mid-rib. Among the segregates recognized by Mrs. Erlanson (l. c.) they are most nearly related to var. *lacorum* or to *R. Engelmanii* S. Wats. However, the form of the fruits seems entirely unique. There is a tendency, particularly on the upper leaves, to sharply acuminate leaflets. This tendency can be seen also in Alaskan and Eastern Asiatic material of *R. acicularis*, and may eventually require further recognition; but except for the cited specimens I have seen no forms that have the peculiar fruits described here.

**Rosa Woodsii** Lindl. Ros. Monogr. 21 (1820); Borrer in Hooker, Fl. Bor.-Am. **1:** 199 (1834), in part; Raup in Jour. Arn. Arb. **17:** 270 (1936).

*Rosa blanda* sensu Borrer in Hooker, Fl. Bor.-Am. **1:** 199 (1834), in part; Porsild in Nat. Mus. Can. Bull. **101:** 34 (1945); non Ait.

Willow thickets on sand bars along Mackenzie R. near Simpson, *9864;* thickets on rocky-sandy bank of Mackenzie R. opposite Simpson, shrubs 1′–2′ high, *9938;* Wrigley, *Wynne-Edwards 8602* (Can.); Mackenzie R. between Wrigley and Blackwater R., *Crickmay 135* (Can.).

Common in these habitats; fruit maturing in late August. Both *R. Woodsii* and *R. blanda* are noted in Fl. Bor.-Am. as ranging northward as far as Great Bear L., but the Mackenzie plants I have seen are fairly uniform and similar to those of the Wood Buffalo Park. The specimens in our no. *9938* and in *Wynne-Edwards'* no. *8602* are notable for having only 1 or 2 flowers together in an inflorescence. This is not unusual in the more southern parts of the range of *R. Woodsii,* but along the Mackenzie it is very common.

**Prunus virginiana** L. var. **demissa** (T. & G.) Torr. in Wilkes, U. S. Explor. Exp. **17:** 284 (1874).

*Cerasus demissa* Nutt. ex T. & G. Fl. N. Am. **1:** 411 (1840).

*Prunus demissa* (Nutt.) D. Dietr.; Raup in Jour. Arn. Arb. **17:** 270 (1936).

*Cerasus virginiana* L. sensu Hooker, Fl. Bor.-Am. **1:** 169 (1834), in part; Macoun, Cat. Can. Pl. Pt. 1: 125 (1883), in part.

*Cerasus serotina* sensu Hooker, Fl. Bor.-Am. **1:** 169 (1834), in part, non Ehrh.

Both *Cerasus virginiana* and *C. serotina* are noted in Fl. Bor.-Am. as far north as lat. 62°, the first to "Great Slave Lake, lat. 62°, where it attains a height of five feet only," and the second simply, "as far as north lat. 62°." Both are probably referable to *P. virginiana* var. *demissa,* but I have seen no other evidence that this plant extends beyond the lower Athabaska R. Preble and Seton also placed its northern limit on the lower Athabaska.

**Prunus pennsylvanica** L. f. Suppl. 252 (1781); Preble in N. Am. Fauna **27:** 528 (1908); Raup in Jour. Arn. Arb. **17:** 271 (1936).

Liard R. between Nahanni Butte and Simpson, *Crickmay 70* (Can.).

## LEGUMINOSAE

**Lupinus arcticus** Wats. in Proc. Am. Acad. **8:** 526 (1873); Macoun, Cat. Can. Pl. Pt. 1: 102 (1883); Porsild in Nat. Mus. Can. Bull. **101:** 23 (1945).

Liard R. between Nahanni Butte and Simpson, *Crickmay 80* (Can.); mossy woods on north shore of Brintnell L., *9180;* open spruce woods on north slope of Colonel Mt., alt. 3000′, *9645;* south slope of Red Mt., above timber line, *9221.*

Common to abundant in high mountain meadows, particularly on the slopes north of Brintnell L., and common also throughout the more open timbered areas; in flower in late June, and maturing its legumes late in July. Porsild noted it as common in a muskeg along the Canol Rd. near Little Keele R., mi. 51 E. I have seen specimens from Great Bear L. and the lower Mackenzie.

**Astragalus frigidus** (L.) Gray var. **americanus** (Hooker) Wats. Bibl. Ind. 193 (1878); Macoun, Cat. Can. Pl. Pt. 1: 113 (1883); Raup in Jour. Arn. Arb. **17**: 271 (1936).

*Phaca frigida* L. var. *americana* Hooker, Fl. Bor.-Am. **1**: 140 (1830).

Providence, *Dutilly* (G); Liard R. between Nahanni Butte and Simpson, *Crickmay 71* (Can.); thicket at margin of upland prairie west of Mackenzie R. near Simpson, *9919*.

Common locally; collected in fruit Aug. 28.

**Astragalus frigidus** (L.) Gray var. **littoralis** (Hooker) Wats. Bibl. Ind. 193 (1878); Porsild in Nat. Mus. Can. Bull. **101**: 23 (1945). See Rhod. **41**: 250 (1939); Contr. Lab. Bot. Univ. Mont. **24**: 48 (1933).

*Phaca frigida* L. var. *littoralis* Hooker, Fl. Bor.-Am. **1**: 140 (1830).

Open spruce woods near timber line and in alpine meadows, north slope of Colonel Mt., alt. 3500′–4300′, *9387, 9658;* along small brook on west slope of Terrace Mt., alt. 4800′, *9557;* Bolstead Cr., Canol Rd., mi. 111 E., alpine turfy slopes, alt. 4500′–5500′, *Wynne-Edwards 8347, 8348* (Can.).

Abundant on the middle north slopes of Colonel Mt. at Brintnell L., but apparently rare elsewhere in that area. Collected with flowers and immature fruit early in July, and with ripe legumes late in July.

**Astragalus striatus** Nutt. in T. & G. Fl. N. Am. **1**: 330 (1838); Porsild in Nat. Mus. Can. Bull. **101**: 33 (1945).

*Astragalus adsurgens* sensu Raup in Jour. Arn. Arb. **17**: 271 (1936), non Pall.

Outwash gravel plain near mouth of North Nahanni R., *Wynne-Edwards 8538* (Can.).

This species was not previously known to extend north of the Wood Buffalo Park.

**Astragalus goniatus** Nutt. in T. & G. Fl. N. Am. **1**: 330 (1838).

*Astragalus hypoglottis* sensu Raup in Jour. Arn. Arb. **17**: 271 (1936).

Junction of the Nyarling and Little Buffalo Rivers, *Russell 5* (G).

Common in the Wood Buffalo Park, and probably having a wider range in the upper Mackenzie country than the scanty records show. In flower about mid-June.

**Astragalus alpinus** L. Sp. Pl. 760 (1753); Macoun, Cat. Can. Pl. Pt. 1: 112 (1883); Raup in Jour. Arn. Arb. **17**: 271 (1936); Porsild in Nat. Mus. Can. Bull. **101**: 33, 34 (1945).

*Phaca astragalina* DC.; sensu Hooker, Fl. Bor.-Am. **1**: 145 (1834).

Fort Smith, *Raup 994* (Coll. *Mrs. Conibear*), *995;* Lobstick Cr., Little Buffalo R., *Russell 4* (G); Mackenzie R., *Onion* (N); south side of Mackenzie R., 10 mi. below Mills L., *Wynne-Edwards 8555* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 77, 78* (Can.); rocky-sandy bank of Mackenzie R. opposite Simpson, *9974;* Wrigley, *Wynne-Edwards 8604, 8605* (Can.); Saline R., above Norman, *Wynne-Edwards 8572* (Can.); high alpine rock crevice, north slope of Colonel Mt., Brintnell L., alt. about 6000′, *9428*.

Apparently rare in the Brintnell L. area, but common in the lower country; in flower in the mountains early in July. Our Simpson specimens approach var. *Brunetianus* Fernald (Rhod. **10**: 51) in habit, with long vine-like zig-zag stems up to 3.5 dm. in length. The ripe legumes, however, are straight and have the rather long, black, partly spreading pubescence of the typical form.

**Astragalus aboriginum** Richardson, Bot. App. Frankl. Journ. 756 (1823); Macoun, Cat. Can. Pl. Pt. 1: 111 (1883).

*Phaca aboriginum* (Richardson) Hooker, Fl. Bor.-Am. **1:** 143 (1830).

*Astragalus vaginatus* sensu Hooker, Fl. Bor.-Am. **1:** 149 (1834), at least in part, non Pall.

"Gravelly ridges, north to Bear Lake," *Richardson* (Can.); river bluff at Simpson, *? 9113.*

There appear to have been no recent collections of this species in the Mackenzie basin except along the upper Peace River (Raup in Contr. Arn. Arb. **6:** 179). In Richardson's original description the only indication of range is "W" meaning "wooded country from latitude 54° to 64° north." Hooker, in Fl. Bor.-Am., gave the range as extending "From Lake Winipeg to the Rocky Mountains, and as far north as Bear Lake, in lat. 66°." *Astragalus vaginatus* is given a similar northern range, "Woody country, between lat. 54° and 64° north." Our specimens from Simpson are doubtfully determined. They were collected about the middle of June when the inflorescences were just forming. The stems are nearly glabrous below and finely appressed-pubescent above, and the leaves are glabrous above.

**Astragalus eucosmus** Robinson in Rhod. **10:** 33 (1908); Raup in Jour. Arn. Arb. **17:** 271 (1936); Porsild in Sargentia **4:** 50 (1943).

*Phaca elegans* Hooker, Bor.-Am. **1:** 144 (1830).

This species has not yet been collected along the upper Mackenzie, though it is known in the Wood Buffalo Park and at Great Bear L. (*J. M. Bell 22899*, Can.).

**Astragalus tenellus** Pursh, Fl. Am. Sept. **2:** 473 (1814); Raup in Jour. Arn. Arb. **17:** 272 (1936).

*Phaca nigrescens* Hooker, Fl. Bor.-Am. **1:** 143 (1830), at least in part.

*Astragalus multiflorus* (Pursh) Gray, sensu Macoun, Cat. Can. Pl. Pt. 1: 114 (1883), at least in part.

Rocky-sandy bank of Mackenzie R. opposite Simpson, *9973;* "Prairies, Ft. Franklin, Mackenzie R.," *Richardson* (Can.).

Common at the Simpson locality; found with flowers and mature pods late in August. I have seen specimens from as far north as Good Hope (*Miss E. Taylor,* Can.).

**Astragalus linearis** (Rydb.) Porsild in Rhod. **41:** 250 (1939); Porsild in Sargentia **4:** 50 (1943).

*Atelophragma lineare* Rydb. in Bull. Torr. Bot. Cl. **40:** 50 (1913), in N. Am. Fl. **24:** 368 (1929).

I have seen no specimens of *A. linearis* from the central part of the Mackenzie basin. However, Porsild collected it in the Richardson Mts. and on the Coppermine R., and I have seen a specimen of it collected in the Lesser Slave L. district (*Brinkman 4073*). It is therefore to be expected along the Mackenzie.

**Astragalus yukonis** M. E. Jones, Rev. Astr. 83, *t. 7, f. 28* (1923); Raup in Jour. Arn. Arb. **17:** 272 (1936); Porsild in Sargentia **4:** 51 (1943).

Rocky-sandy bank of Mackenzie R. opposite Simpson, *9972;* willow thickets on Mackenzie R. sand bars near Simpson, *9085, 9859.*

Common to abundant in these habitats; collected in flower about mid-June, and with mature legumes late in August. *Astragalus yukonis* was based upon plants collected by Gorman (no. *1082*) on the Yukon near Ft. Selkirk and by

Miss Alice Eastwood at Whitehorse. It is probably identical with Rydberg's *Homalobus retusus,* the type of which was also collected at Ft. Selkirk by Tarlton (nos. *128-A, 128-B*) (Bull. Torr. Bot. Cl. **50:** 186, 1923). The Gorman number was cited provisionally by Rydberg as identical with his type of *Homalobus retusus.* Although *A. yukonis* antedates the latter by some months, it is not mentioned by Rydberg in his later monograph (N. Am. Fl. **24:** 266, 1929).

Both of the above descriptions call for a plant with black-hairy calyces and legumes, but ours have considerable white hair among the black. This is also true of specimens collected along the lower Athabaska R. (*Raup 990*). The species has also been collected in the Mackenzie delta by Porsild.

**Oxytropis retrorsa** Fernald in Rhod. **30:** 140 (1928); Raup in Jour. Arn. Arb. **17:** 272 (1936); Porsild in Sargentia **4:** 55 (1943).

This species has not been collected in southwestern Mackenzie, but is to be expected there. Porsild has collected it at Great Bear L. and in the Eskimo Lakes basin, while it is known on the lower Athabaska (Raup 1. c.) and in the Peace R. region (Raup in Jour. Arn. Arb. **23:** 20, 1942).

**Oxytropis foliolosa** Hooker, Fl. Bor.-Am. **1:** 146 (1834). See Fernald in Rhod. **30:** 139 (1928).

Gravelly thickets at west end of Brintnell L., *9431.*

Common on this site, but not observed elsewhere; found with flowers and maturing pods about mid-July.

**Oxytropis hudsonica** (Greene) Fernald in Rhod. **30:** 142 (1928); Raup in Jour. Arn. Arb. **17:** 272 (1936); Porsild in Sargentia **4:** 53 (1943), in Nat. Mus. Can. Bull. **101:** 23, 32 (1945).

*Aragallus hudsonicus* Greene in Proc. Biol. Soc. Wash. **18:** 17 (1905).

Gravelly-stony fan on south shore of Brintnell L., *9586;* dry rock gully on south-facing slope of granite mountain west of Brintnell L., *9482;* Lone Mt., *Wynne-Edwards 8491* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8342* (Can.); same place, *Porsild 11832* (Can.).

Occasional to common in the Brintnell L. habitats noted; found with flowers and mature legumes in late July. Known also from Great Slave L. (Raup, 1. c.), Great Bear L. (*J. M. Bell,* Can.; *Porsild,* Can.), the arctic coast (*Porsild*), and the Richardson Mts. (*Porsild*).

**Oxytropis Maydelliana** Trautv. in Acta Horti Petrop. **6:** 16 (1879); Porsild in Nat. Mus. Can. Bull. **101:** 23 (1945). See Fernald in Rhod. **30:** 142 (1928).

Alpine crevices, ledges, and rock-slides, north slope of Colonel Mt., *9426;* Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11818* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alpine ridge, alt. 6500′–7000′, *Wynne-Edwards 8341* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11872* (Can.).

Very common on rocky slopes and local summits on Colonel Mt., but not seen elsewhere in the vicinity of Brintnell L.; collected with flowers and maturing fruit early in July.

**Oxytropis podocarpa** Gray in Proc. Am. Acad. **6:** 234 (1864). See Fernald in Rhod. **30:** 154 (1928).

Liard R. between Nahanni Butte and Simpson, *Crickmay 76* (Can.).

**Oxytropis pygmaea** (Pall.) Fernald in Rhod. **30:** 153 (1928); Porsild in Nat. Mus. Can. Bull. **101:** 23 (1945).

*Astragalus pygmaeus* Pall. Sp. Astrag. 66, *t. 54* (1800).

Shale crevices, ledges and slide rock on north slope of Colonel Mt., above timber line, *9398, 9636;* Bolstead Cr., Canol Rd., mi. 111 E., alpine slope, alt. 6000′, *Wynne-Edwards 8345* (Can.).

Common at the Brintnell L. locality cited, but not seen elsewhere in that region; collected with flowers and maturing legumes early in July. Noted by Porsild in the Richardson Mts. and at the Mackenzie delta (Sargentia **4**: 55).

**Oxytropis hyperborea** A. E. Porsild in Sargentia **4**: 53 (1943), in Nat. Mus. Can. Bull. **101**: 23, 31 (1945).

Liard R. between Nahanni Butte and Simpson, *Crickmay 75* (Can.) (? doubtful); gravelly thickets near west end of Brintnell L., *9449;* alpine meadows and open places in willow-birch scrub, north slope of Colonel Mt., *9427;* north peak of Nahanni Mt., *Wynne-Edwards 8490* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alpine bog, alt. 5000′, *Wynne-Edwards 8343, 8344* (Can.).

Common in the Brintnell L. habitats noted; in flower early in July, those at lake-level with maturing pods July 10.

**Oxytropis terrae-novae** Fernald in Rhod. **30**: 147, *pl. 174* (1928); Porsild in Nat. Mus. Can. Bull. **101**: 24 (1945).

Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11817* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Porsild 11833* (Can.); same place, alpine slope, alt. 6000′, *Wynne-Edwards 8346* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11873* (Can.).

Found in flower at Bolstead Cr. July 25, and in fruit Sept. 6. Porsild states that this species "appears to be one of the most common members of this genus on the upper slopes of mountains east of the Yukon–Mackenzie divide where it grows in turfy places on limestone barrens."

**Oxytropis campestris** (L.) DC. (s. str.) Astrag. 74 (1802); Porsild in Sargentia **4**: 52 (1943); ? Porsild in Nat. Mus. Can. Bull. **101**: 23 (1945).

*Astragalus campestris* L. Sp. Pl. 761 (1753).

*Oxytropis gracilis* sensu Raup in Jour. Arn. Arb. **17**: 272 (1936), non Nels.

Northwest shore of Great Slave L., *Bedford* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Porsild 11834* (Can.) (doubtfully determined).

Porsild (Sargentia **4**: 52) believes that some northern specimens in this group are a close match for the northern European *O. campestris*. Another from the Mackenzie basin was collected at Good Hope by *Miss E. Taylor* (*5353,* Can.). Two other specimens from Great Slave L. may be referred here tentatively: southwest and north shores, *Howe 91977, 91978* (Can.) (as *O. Lamberti* in Raup, l. c.).

**Oxytropis spicata** (Hooker) Standley in Contr. U. S. Nat. Herb. **22**: 373 (1921).

*Oxytropis campestris* (L.) DC. var. *spicata* Hooker, Fl. Bor.-Am. **1**: 147 (1834).

Fragmentary specimens collected by *Crickmay* (*73, 74,* Can.) along the Liard R. between Nahanni Butte and Simpson are referred somewhat doubtfully to this species. They consist only of inflorescenses. I have collected *O. spicata* along the upper Peace R., and have seen specimens from near the height of land between the Peace and the Nelson (Raup in Contr. Arn. Arb. **6**: 180). Consequently it might well be expected to appear on the Liard.

**Oxytropis viscidula** (Rydb.) Tidestr. in Contr. U. S. Nat. Herb. **25**: 332 (1925); Raup in Jour. Arn. Arb. **17**: 272 (1936).

*Aragallus viscidulus* Rydb. in Mem. N. Y. Bot. Gard. **1**: 253 (1900).

Northwest shore of Great Slave L., *Bedford* (Can.).

**Oxytropis ixodes** Butters & Abbe in Rhod. **45**: 2, *t. 745* (1943).

Mossy banks in woods on south shore of Brintnell L., *9325;* alpine meadows and crevices, north slope of Colonel Mt., alt. 4000′–6000′, *9399, 9635.*

Common to abundant in the above sites; in flower late in June, and found with mature legumes July 28.

When we collected this species at Brintnell Lake in 1939 it was soon recognized as unique, and a description of it was drawn up. I have seen a cotype of *O. ixodes,* and Butters & Abbe's description and plate so nearly cover our Mackenzie Mountain plants that I do not hesitate to identify the latter with the Minnesota material. In support of this, and in order further to emphasize the characters of the species, I venture to include here the original description that I wrote earlier.

Subacaulescent herb with thick, branched caudex; stipules yellowish-straw-colored, ovate, acuminate, long-ciliate on the margins, glabrous; leaves 3–15 cm. long; leaflets 23–27, rather thick, lanceolate or oblong, 3–11 mm. long, revolute, ciliate and viscid-glandular at the margins; rachis thinly hirsute with white, spreading hairs, viscid; scapes equaling or somewhat exceeding the leaves, loosely hairy with mixed black and white hairs; inflorescence 3- to 10-flowered, loosely subcapitate; bracts lance-attentuate, black- and white-ciliate, viscid, up to 1 cm. long; calyx densely black-hairy with a few white hairs mixed, 6–8 mm. long, tinged with blue at least when dry, the lobes lance-attenuate, 4–5.5 mm. long, viscid-glandular, thinly black-hairy or glabrous; corolla blue to pale purple, up to 18 mm. long; legume narrowly ovoid, the body about 1.5 cm. long, black- and white-hairy and glandular-verrucose, tapering to a long slender beak.

I agree with Butters and Abbe that the affinities of *Oxytropis ixodes* are clearly with the primarily eastern arctic *O. hudsonica* (Greene) Fernald (see Rhod. 30: 142), and with the cordilleran *O. viscida* Nutt. or *O. viscidula* (Rydb.) Tidestrom. All of these are characterized by their viscid glandularity.

I have seen a few other northwestern specimens that appear to be identical with the Mackenzie Mt. plants. They were collected by *A. E. Porsild* at Castner Glacier, Alaska Range, no. *495* (see Rhod. 41: 251), and by *Miss Edith Scamman* in Mt. McKinley Park, no. *651* (see Rhod. **42**: 333). Another specimen in the Gray Herbarium, collected by *Aven* and *Ruth Nelson* in Mt. McKinley Park, no. *3582,* was distributed as *O. viscida* but belongs here. A specimen collected by *G. M. Dawson* on the upper Liard R. may also be referable to *O. ixodes.*

**Oxytropis splendens** Dougl. in Hooker, Fl. Bor.-Am. **1**: 147 (1834); Raup in Jour. Arn. Arb. **17**: 272 (1936); Porsild in Nat. Mus. Can. Bull. **101**: 34 (1945).

*Oxytropis splendens* Dougl. var. *Richardsonii* Hooker, Fl. Bor.-Am. **1**: 148 (1834); Macoun, Cat. Can. Pl. Pt. 1: 116 (1883).

First point north of Gypsum Pt., Great Slave L., *Hume 102671* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 72* (Can.); Saline R., above Norman, *Wynne-Edwards 8573* (Can.).

Noted in Fl. Bor.-Am. as occurring "From Cumberland House . . . to Fort Franklin and the Bear Lake."

**Hedysarum alpinum** L. var. **americanum** Michx. ex Pursh, Fl. Am. Sept. 2: 484 (1814); Raup in Jour. Arn. Arb. **17**: 273 (1936); Rollins in Rhod. **42**: 222 (1940); Porsild in Nat. Mus. Can. Bull. **101**: 32 (1945).

*Hedysarum alpinum americanum* Michx. Fl. Bor.-Am. **2**: 74 (1803).

*Hedysarum boreale* sensu Hooker, Fl. Bor.-Am. **1**: 155 (1834); Macoun, Cat. Can. Pl. Pt. 1: 117 (1883).

Southwest and north shores of Great Slave L., *Howe 91991* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Mackenzie R., *Onion & Ross* (N); Liard R. between Nahanni Butte and Simpson, *Crickmay 79* (Can.); among willows on Mackenzie R. sand bar near Simpson, *9084;* gravelly thickets near west end of Brintnell L., *9442;* mossy bank on south shore of Brintnell L., *9328;* mossy ledges in upper part of timber and in alpine meadows and scrub, north slope of Colonel Mt., alt. 3000′–4000′, *9423, 9637;* north peak of Nahanni Mt., *Wynne-Edwards 8492* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alt. 5000′, alpine slopes, *Wynne-Edwards 8350* (Can.).

Common in the Brintnell L. area, but like *H. Mackenzii* it was not seen on the mountains north of the lake; in flower in late June and early July; fruit maturing in middle and late July. Noted in Fl. Bor.-Am. ". . . from the Saskatchewan to the Arctic Circle." I have seen specimens from Great Bear L. (*J. M. Bell,* Can.), and from the lower Mackenzie (*McConnell, Miss E. Taylor,* Can.).

**Hedysarum Mackenzii** Richardson, Bot. App. Frankl. Journ. 745 (1823); Raup in Jour. Arn. Arb. **17:** 273 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 24 (1945). See Rollins in Rhod. **42:** 237 (1940).

Northwest shore of Great Slave L., *Bedford* (Can.); Mackenzie R., *Richardson* (Can.); rocky-sandy bank of Mackenzie R. opposite Simpson, *9942;* gravel beaches and fans, south shore of Brintnell L., *9346, 9592;* alpine meadows, rock-slides and crevices, north slope of Colonel Mt., alt. 4500′–5500′, *9390, 9638;* Bolstead Cr., Canol R., mi. 111 E., *Wynne-Edwards 8349* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11871* (Can.).

Common on the south shore of Brintnell L. and on Colonel Mt., but not observed north of the lake; in flower early in July, and with mature fruit the last week in July. Fruiting specimens of this species from the Brintnell L. district (*9592, 9638*) have unusually large loments. Rollins (1. c.) gives the size of the individual articles of the loments as 4–6 mm. wide and 5–8 mm. long. On our plants they are commonly 7 mm. wide and 9 (sometimes 9.5–10 mm.) long.

**Vicia americana** Muhl. in Willd. Sp. Pl. **3:** 1096 (1803); Hooker, Fl. Bor.-Am. **1:** 157 (1834); Macoun, Cat. Can. Pl. Pt. 1: 121 (1883); Raup in Jour. Arn. Arb. **17:** 273 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 33, 34 (1945).

Fort Smith, *Raup 1006;* Hay River, Great Slave L., *Hume 102670* (Can.); Providence, *Dutilly 60* (G); south bank of Mackenzie R., 10 mi. below Mills L., *Wynne-Edwards 8553* (Can.); Wrigley, *Wynne-Edwards 8603* (Can.); Saline R., above Norman, *Wynne-Edwards 8624* (Can.).

Noted in Fl. Bor.-Am. as extending to Great Bear L. The narrow-leaved form of the species (var. *angustifolia* Nees) is occasional in the Wood Buffalo Park (Raup, 1. c.), and has been found along the lower Slave R. (*Raup 1009*).

**Lathyrus ochroleucus** Hooker, Fl. Bor.-Am. **1:** 159 (1834); Macoun, Cat. Can. Pl. Pt. 1: 123 (1883); Raup in Jour. Arn. Arb. **17:** 273 (1936).

Fort Smith, *Raup 986;* same place, *Miss E. Taylor 5507* (Can.); same place, *Seton & Preble 78319, 78320* (Can.); Resolution, *Onion, Kennicott & Hardisty* (N); Providence, *Preble & Cary 41* (US); along roadside in lowland woods, Simpson, *9097;* Mackenzie R., *Onion* (N).

Noted in Fl. Bor.-Am. as occurring ". . . throughout the whole woody country to Bear Lake, in lat. 66°."

## GERANIACEAE

**Geranium Bicknellii** Britton in Bull. Torr. Bot. Cl. **24:** 92 (1897); Raup in Jour. Arn. Arb. **17:** 274 (1936). See Fernald in Rhod. **37:** 296 (1935).

Fort Smith, *Raup 1011.*

This species is occasional to common in the Wood Buffalo Park, particularly in recently burned forest. It is probably widespread in the upper Mackenzie country.

## LINACEAE

**Linum Lewisii** Pursh, Fl. Am. Sept. **1:** 210 (1814); Raup in Jour. Arn. Arb. **17:** 274 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 34 (1945).

*Linum perenne* sensu Hooker, Fl. Bor.-Am. **1:** 106 (1830); Macoun, Cat. Can. Pl. Pt. 1: 89 (1883); non L.

Mackenzie R., *Onion* (N); Liard R. between Nahanni Butte and Simpson, *Crickmay 82* (Can.); thickets on rocky-sandy bank of Mackenzie R. opposite Simpson, *9970;* Wrigley, *Wynne-Edwards 8608* (Can.); Norman, *Kindle* (Can.); same place, *Dutilly* (G).

Common at Simpson; found with mature fruit and occasional late flowers Aug. 29. Noted in Fl. Bor.-Am. ". . . as far north as the shores of the Arctic Sea," but I have seen no material from beyond Great Bear L. (*J. M. Bell,* Can.).

## CALLITRICHACEAE

**Callitriche verna** L., emend. Loennr. Obs. crit. pl. Suec. illustr. Upsaliae. 17 (1854); Porsild in Sargentia **4:** 55 (1943).

*Callitriche palustris* L. sensu Raup in Jour. Arn. Arb. **17:** 274 (1936).

Northwest shore of Great Slave L., *Bedford* (Can.).

Porsild has collected this species in the Keewatin District, at Great Bear L., and in the Eskimo Lakes basin. It is probably common throughout the lowland parts of our region.

**Callitriche autumnalis** L. Fl. Suec. ed. 2, 4 (1755); Hooker, Fl. Bor.-Am. **1:** 217 (1834); Porsild in Sargentia **4:** 55 (1943).

*Callitriche hermaphroditica* L. sensu Raup in Jour. Arn. Arb. **17:** 274 (1936).

This species has not yet been collected in the upper Mackenzie country. It is common in the Wood Buffalo Park, however, and Porsild has collected it in several places at Great Bear L. and in the lower Mackenzie region. It is noted in Fl. Bor.-Am. as occurring ". . . as far north as Bear Lake, lat. 66°." There is a Richardson specimen in Herb. Can. marked "North of the Saskatchewan," but without further locality data.

## EMPETRACEAE

**Empetrum nigrum** L. Sp. Pl. 1022 (1753); Hooker, Fl. Bor.-Am. **2:** 140 (1838); Macoun, Cat. Can. Pl. Pt. 3: 458 (1886); Preble in N. Am. Fauna **27:** 529 (1908); Raup in Jour. Arn. Arb. **17:** 274 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 24 (1945).

Southwest and north shores of Great Slave L., *Howe 91979* (Can.); 12 mi. E. of Moraine Pt., Great Slave L., *Bedford* (Can.); east shore of Trout L., *C. O. Hage* (G); mossy thickets along shore of Brintnell L., *9186;* alpine meadows on east slope of Red Mt., alt. 5000′, *9743;* Bolstead Cr., Canol R., mi. 111 E., alpine slopes, alt. 5500′, *Wynne-Edwards 8352* (Can.).

Common to abundant on turfy alpine slopes at Brintnell L., and occasional in the woods at lake-level; a primary species in parts of the scrub and alpine meadow communities on the east slope of Red Mt., all the way to the summit. Mature fruit collected Aug. 7. Noted in Fl. Bor.-Am. "Throughout the woody and barren country, abundant. . . ." Preble states that it "occurs nearly throughout the region," and that "It reaches its greatest luxuriance on the northern border of the forest. . . ."

## BALSAMINACEAE

**Impatiens Noli-tangere** L. Sp. Pl. 938 (1753); Raup in Jour. Arn. Arb. **17:** 274 (1936). See Raup in Nat. Mus. Can. Bull. **74:** 149 (1935).

*Impatiens fulva* sensu Hooker, Fl. Bor.-Am. **1:** 117 (1830), in part; Macoun, Cat. Can. Pl. Pt. 1: 92 (1883), in part; non Nutt.

This species appears to be rather rare in the Mackenzie basin. It has been found around the western end of L. Athabaska (Raup, l. c.) and in the upper Peace R. country (Raup in Contr. Arn. Arb. **6**: 183). The only basis for including it in the present flora is the range given by Hooker in Fl. Bor.-Am., "Throughout Canada; and as far north as Bear Lake, lat. 66°." There is a Richardson specimen in Herb. Can., originally labeled *I. fulva* and marked "Arctic Nth. Am.," but without more specific locality data.

## CISTACEAE

**Hudsonia tomentosa** Nutt. var. **intermedia** Peck in 45th Rept. N. Y. State Mus. 26 (1893); Raup in Jour. Arn. Arb. **17**: 275 (1936).

*Hudsonia tomentosa* Nutt. sensu Hooker, Fl. Bor.-Am. **1**: 73 (1830), in part; Macoun, Cat. Can. Pl. Pt. 1: 60 (1883), in part.

Noted in Fl. Bor.-Am. as occurring "as far north as Slave Lake." It is abundant on sandy beach ridges and dunes around L. Athabaska, and will probably be found again in similar situations farther north.

## VIOLACEAE

**Viola nephrophylla** Greene, Pittonia **3**: 144 (1896); Raup in Jour. Arn. Arb. **17**: 275 (1936).

The only basis for including this species in the present flora is the record in Fl. Bor.-Am. (**2**: 75) for the closely related *V. cucullata* Ait., "Throughout Canada . . . and as far north as the Mackenzie River and Bear Lake." *Viola cucullata* has never been collected in the Mackenzie basin, but *V. nephrophylla* occurs in the Wood Buffalo Park, and in the upper Peace R. region (Raup in Contr. Arn. Arb. **6**: 183). I have seen no Richardson specimens from the north, however, nor any Fl. Bor.-Am. material marked *V. cucullata*.

**Viola epipsila** Ledeb. Ind. Sem. Hort. Dorpat, 5 (1820). See Fernald in Mem. Am. Acad. **15**: 268, footnote 5 (1925).

Damp places along streams, upper valley of Frost Cr., north of Brintnell L., alt. 4000′–4500′, *9287, 9550.*

Rare or occasional; found flowering in late June and mid-July.

**Viola renifolia** Gray var. **Brainerdii** (Greene) Fernald in Rhod. **14**: 88 (1912); Raup in Jour. Arn. Arb. **17**: 276 (1936); Porsild in Sargentia **4**: 55 (1943), in Nat. Mus. Can. Bull. **101**: 32 (1945).

*Viola blanda* sensu Hooker, Fl. Bor.-Am. **1**: 76 (1830), in part; Macoun, Cat. Can. Pl. Pt. 1: 62 (1883), in part; non Willd.

Mackenzie R., *Onion* (N); Simpson, *Onion, Kennicott & Hardisty* (N); same place, damp places, *Miss E. Taylor 2365* (Can.), *25* (G); same place, damp lowland woods, *9093, 9107;* Lone Mt., *Wynne-Edwards 8493* (Can.).

Occasional to common at Simpson; in flower about mid-June. Noted in Fl. Bor.-Am. as extending "as high north as Fort Franklin, in lat. 66°." Porsild has collected it at Great Bear L.

**Viola adunca** J. E. Sm. in Rees Cyclop. **38**: no. 63 (1817); Raup in Jour. Arn. Arb. **17**: 276 (1936).

Mackenzie R., *Hardisty* (N); same, *Kennicott* (N); Simpson, *Preble 310* (US); old field at Simpson, *9129;* Willow Lake R., 44 mi. above mouth, *Crickmay 1* (Can.).

Abundant at Simpson; in flower about mid-June.

## ELAEAGNACEAE

**Elaeagnus commutata** Bernh. in Allg. Thuer. Gartenz. **2:** 137 (1843); Raup in Jour. Arn. Arb. **17:** 276 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 34 (1945).

*Elaeagnus argentea* Pursh, sensu Hooker, Fl. Bor.-Am. **2:** 137 (1838); Macoun, Cat. Can. Pl. Pt. 3: 420 (1886); Preble in N. Am. Fauna **27:** 530 (1908); non Moench.

Hay River, Great Slave L., *Preble & Cary 18* (US); shale bluff of Mackenzie R. opposite Simpson, shrubs up to 4′ high, *9971;* Wrigley, *Miss E. Taylor* (N), *18* (Can.), *13* (G); Norman, *Dutilly 47* (G); Saline R., above Norman, *Wynne-Edwards 8574* (Can.).

Common at Simpson; in fruit late in August. Noted in Fl. Bor.-Am. as occurring northward ". . . to lat. 69° near the coast." Preble does not report it beyond the Norman district.

**Shepherdia canadensis** (L.) Nutt. Gen. **2:** 240 (1818); Hooker, Fl. Bor.-Am. **2:** 138 (1838); Macoun, Cat. Can. Pl. Pt. 3: 421 (1886); Raup in Jour. Arn. Arb. **17:** 276 (1936); Porsild in Sargentia **4:** 55 (1943).

*Elaeagnus canadensis* L. Sp. Pl. 1024 (1753).

*Lepargyrea canadensis* (L.) Greene; Preble in N. Am. Fauna **27:** 530 (1908).

Fort Smith, *Seton & Preble 78389* (Can.); same place, *Raup 1034;* Bear R., *Russell* (G); Resolution, *E. A. & A. E. Preble 144* (US); southwest and north shores of Great Slave L., *Howe 91982* (Can.); northwest shore, Great Slave L., *Bedford* (Can.); damp lowland woods at Simpson, shrub 4′ high, *9083;* alpine scrub above timber line on north slope of Colonel Mt., *9369.*

Common in rich woods around Brintnell L. and high up on the slope of Colonel Mt., but only occasional on the mountains north of the lake; in flower in the mountains early in July. Noted in Fl. Bor.-Am. "Throughout Canada to Fort Franklin on the Mackenzie River . . ."; and by Preble ". . . throughout the country north to the edge of the timber." I have seen a specimen from Good Hope (*Miss E. Taylor,* Can.), and Porsild has collected it in the Mackenzie delta.

## ONAGRACEAE

**Epilobium angustifolium** L. Sp. Pl. 347 (1753); Hooker, Fl. Bor.-Am. **1:** 205 (1834); Macoun, Cat. Can. Pl. Pt. **1:** 168 (1883); Raup in Jour. Arn. Arb. **17:** 277 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 24 (1945).

Fort Smith, *Raup 1053* (*Mrs. Conibear,* coll.); Clewi R., *Russell 76* (G); Hay River, Great Slave L., *Hume 102672* (Can.); 12 mi. E. of Moraine Pt., Great Slave L., *Bedford* (Can.); east shore of Trout L., *C. O. Hage* (G); Mackenzie R., *Kennicott* (N); Liard R. between Nahanni Butte and Simpson, *Crickmay 81* (Can.); gravelly thickets on Camp Pt., Brintnell L., *9574;* turfy slopes on south side of Red Mt., alt. 5000′, *9763;* Nahanni Mts., *Preble & Cary 56* (US).

Common around Brintnell L., and on the mountains north of the lake, but not observed on Colonel Mt.; in flower in late July and early August. Noted in Fl. Bor.-Am. ". . . to north lat. 69°." Porsild states that it is common in Macmillan Pass, on the Canol Rd.

Our Brintnell L. plants, though tall, have rather short, narrowly lanceolate leaves, approaching var. *intermedium* (Wormsk.) Fernald (in Rhod. **20:** 5, 1918).

**Epilobium latifolium** L. Sp. Pl. 347 (1753); Hooker, Fl. Bor.-Am. **1:** 205 (1834); Macoun, Cat. Can. Pl. Pt. 1: 169 (1883); Raup in Jour. Arn. Arb. **17:** 277 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 24, 34 (1945).

Northwest shore of Great Slave L., *Bedford* (Can.); Saline R., above Norman, *Wynne-Edwards 8575* (Can.); muskegs and gravel beaches along shores of Brintnell L., *9348, 9329;* open spruce woods on north slope of Colonel Mt., alt. 3000′, *9646;* Bolstead Cr., Canol Rd., mi. 111 E., alpine bog, alt. 4700′, *Wynne-Edwards 8351* (Can.).

At Brintnell L. this species is common to abundant on gravel beaches and on the north slope of Colonel Mt. up to an altitude of about 6000′; rare or occasional on the mountains north of the lake. In flower late in June, and with maturing fruit late in July. Porsild reports it as common throughout the route of the Canol Road through the Mackenzie Mts.

**Epilobium palustre** L. Sp. Pl. 348 (1753); Raup in Jour. Arn. Arb. **17**: 277 (1936); Porsild in Sargentia **4**: 56 (1943), in part.

Little Buffalo R., *Russell 76* (G).

Common in the Wood Buffalo Park (Raup in Nat. Mus. Can. Bull. **74**: 151), and known also at Great Bear L. (*J. M. Bell, Porsild,* Can.).

**Epilobium palustre** L. var. **monticola** Haussk. in Oest. Bot. Zeit. **29**: 119 (1879); Raup in Jour. Arn. Arb. **17**: 277 (1936).

*Epilobium palustre* L. var. *albiflora* Hooker, Fl. Bor.-Am. **1**: 207 (1834).

*Epilobium palustre* L. var. *lineare* Gray, sensu Macoun, Cat. Can. Pl. Pt. 1: 170 (1883), at least in part.

This is the small, strict, narrow-leaved form of the species. It is occasional in the Athabaska L. and Wood Buffalo Park districts, though I have seen no material from southwestern Mackenzie. Hooker, in Fl. Bor.-Am., gives its range as "Throughout Canada, and as far north as lat. 64°. . . ."

**Epilobium glandulosum** Lehm. var. **adenocaulon** (Haussk.) Fernald in Rhod. **20**: 35 (1918); Raup in Jour. Arn. Arb. **17**: 277 (1936).

*Epilobium adenocaulon* Haussk. in Oest. Bot. Zeit. **29**: 119 (1879).

*Epilobium tetragonum* sensu Hooker, Fl. Bor.-Am. **1**: 206 (1834), in part; Macoun, Cat. Can. Pl. Pt. 1: 169 (1883), in part; non L.

Northwest shore of Great Slave L., *Bedford* (Can.); bank of Mackenzie R. a few miles below Providence, *9977;* muskeg along road on west bank of Mackenzie R. near Simpson, *9911.*

Common along the upper Mackenzie; collected with flowers and maturing capsules Aug. 24. Hooker's record for *E. tetragonum,* ". . . throughout the plains to lat. 64°. . . ," probably should be referred to this species, at least in part.

**Epilobium davuricum** Fisch. ex Hornem. Suppl. Hort. Bot. Hafn. 44 (1819); Porsild in Sargentia **4**: 56 (1943).

Mossy muskeg thickets at west end of Brintnell L., *9439, 9717.*

Common in this habitat; in flower early in July, and in fruit early in August. Collected in the Mackenzie delta and at Great Bear L. by Porsild.

**Epilobium lactiflorum** Haussk. in Oest. Bot. Zeit. **29**: 89 (1879); Porsild in Nat. Mus. Can. Bull. **101**: 24 (1945).

Gravelly thickets on south shore of Brintnell L., *9334;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11249* (Can.).

Common locally at Brintnell L., in the habitat mentioned above; in flower June 30.

**Epilobium anagallidifolium** Lam. Encycl. Méth. **2**: 376 (1786); Porsild in Nat. Mus. Can. Bull. **101**: 24 (1945).

Along small brook on west slope of Terrace Mt., north of Brintnell L., alt. 5000′, *9549;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11250* (Can.).

Noted as rare or occasional both at Brintnell L. and Macmillan Pass; collected in flower July 18.

HALORHAGIDACEAE

**Myriophyllum exalbescens** Fernald in Rhod. **21:** 120 (1919); Raup in Jour. Arn. Arb. **17:** 278 (1936); Porsild in Sargentia **4:** 56 (1943).

*Myriophyllum spicatum* sensu Hooker, Fl. Bor.-Am. **1:** 216 (1834); Macoun, Cat. Can. Pl. Pt. 1: 166 (1883); non L.

This species has not yet been collected in southwestern Mackenzie, though it is undoubtedly widespread in the upper Mackenzie valley. It is abundant in the Wood Buffalo Park, and Porsild has collected it in the Mackenzie delta and in the Eskimo Lakes basin. In Fl. Bor.-Am. it was noted ". . . as far north as Bear Lake."

HIPPURIDACEAE

**Hippuris vulgaris** L. Sp. Pl. 4 (1753); Hooker, Fl. Bor.-Am. **1:** 217 (1834); Macoun, Cat. Can. Pl. Pt. 1: 167 (1883); Raup in Jour. Arn. Arb. **17:** 278 (1936).

Sass Cr., *Russell 39* (G); 12 mi. E. of Moraine Pt., Great Slave L., *Bedford* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 83* (Can.); Norman, (*Coll.?*) (N).

Hooker noted this species as occurring northward only to lat. 60°. Its extent below Norman is unknown.

**Hippuris montana** Ledeb. in Reichenb. Icon. Bot. **1:** 71, *t. 86, f. 181* (1823).

In pools in muskeg thickets at west end of Brintnell L., *9720.*

Occasional in this habitat, partly floating and partly emergent in pools formed by beaver dams; only sterile plants found.

ARALIACEAE

**Aralia nudicaulis** L. Sp. Pl. 274 (1753); Hooker, Fl. Bor.-Am. **1:** 274 (1834); Macoun, Cat. Can. Pl. Pt. 1: 189 (1883); Raup in Jour. Arn. Arb. **17:** 278 (1936).

This species is abundant in open woods throughout the Wood Buffalo Park, and was reported in Fl. Bor.-Am. as extending northward to lat. 64°. I have seen no specimens, however, from the upper Mackenzie valley.

UMBELLIFERAE

**Cicuta Douglasii** (DC.) Coult. & Rose in Contr. U. S. Nat. Herb. **7:** 95 (1900). See Mathias & Constance in N. Am. Fl. **28B:** 155 (1944).

*Cicuta occidentalis* Greene; Raup in Jour. Arn. Arb. **17:** 279 (1936).

*Cicuta maculata* sensu Hooker, Fl. Bor.-Am. **1:** 259 (1834), in part; Macoun, Cat. Can. Pl. Pt. 1: 181 (1883), in part; non L.

This species is occasional in wet meadows throughout the lower Athabaska R. region and the Wood Buffalo Park. As *C. maculata* it was noted in Fl. Bor.-Am. "between lat. 54° and 64° North." I have seen no specimens from beyond the 60th parallel, though the species probably extends into the upper Mackenzie valley.

**Cicuta mackenzieana** Raup in Jour. Arn. Arb. **17:** 279, *pl. 197* (1936); Porsild in Sargentia **4:** 56 (1943).

*Cicuta virosa* sensu Hooker, Fl. Bor.-Am. **1:** 259 (1834), in part; Macoun, Cat. Can. Pl. Pt. 1: 182 (1883), in part; non L.

Liard R. between Nahanni Butte and Simpson, *Crickmay 84* (Can.).

The material cited under *C. virosa* in Fl. Bor.-Am., ". . . between lat. 54° and 64°" is probably for the most part referable to this species. It has been collected as far north as the Eskimo Lakes basin (Porsild, l. c.).

**Sium suave** Walt. Fl. Car. 115 (1788); Raup in Jour. Arn. Arb. **17:** 280 (1936). See Rhod. **17:** 131 (1915).

*Cicuta virosa* sensu Hooker, Fl. Bor.-Am. **1:** 259 (1834), in part, non L.

Resolution, *Kennicott* (N); northwest shore of Great Slave L., *Bedford* (Can.); Rae, *Bedford* (Can.); sand bar along Mackenzie R. at mouth of small creek opposite Simpson, *9943.*

Occasional at the Simpson locality; fruit mature in late August. A Richardson specimen of *S. suave* at Herb. Can. was originally labeled *Cicuta virosa*, indicating Hooker's confusion of these two species.

**Heracleum lanatum** Michx. Fl. Bor.-Am. **1:** 166 (1803); Hooker, Fl. Bor.-Am. **1:** 269 (1834); Macoun, Cat. Can. Pl. Pt. 1: 187 (1883); Raup in Jour. Arn. Arb. **17:** 280 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 24 (1945).

Stony-gravelly shore of Great Slave L. at Wrigley Harbor, *9982;* east shore of Trout L., *C. O. Hage* (G); thickets along glacial stream near west end of Brintnell L., *9702;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11252* (Can.).

Common along the south shore of Brintnell L. near the western end, but not seen elsewhere. Fruit mature early in August. Noted in Fl. Bor.-Am. ". . . as far north as the Mackenzie River. . . ."

## CORNACEAE

**Cornus canadensis** L. Sp. Pl. 118 (1753); Hooker, Fl. Bor.-Am. **1:** 277 (1834); Macoun, Cat. Can. Pl. Pt. 1: 190 (1883); Preble in N. Am. Fauna **27:** 530 (1908); Raup in Jour. Arn. Arb. **17:** 281 (1936); Porsild in Sargentia **4:** 56 (1943), in Nat. Mus. Can. Bull. **101:** 24 (1945).

Fort Smith, *Miss E. Taylor* (G, N, Can.); same place, *Seton & Preble 78332* (Can.); Little Buffalo R., *Russell 70* (G); Hay River, Great Slave L., *Hume 102673* (Can.); same place, *Preble & Cary 22* (US); northwest shore of Great Slave L., *Bedford* (Can.); near Rae, *Russell* (Can.); east shore of Trout L., *C. O. Hage* (G); Liard R. between Nahanni Butte and Simpson, *Crickmay 85* (Can.); Simpson, *Hardisty* (N); same place, *Onion, Kennicott & Hardisty* (N); rich lowland woods at Simpson, *9098;* on Cap Mt., Wrigley, *Brooke* (Can.); mossy spruce woods on Camp Pt., Brintnell L., *9310;* Nahanni Mts., *Preble & Cary 66* (US).

Abundant in woods throughout the region, and extending up to timber line on Red Mt. at Brintnell L.; in flower the last of June. Porsild noted it as common in Macmillan Pass, along the Canol Rd., and states that he did not see it at Great Bear L., although he collected it on Mt. Charles along the Bear River.

**Cornus canadensis** L. forma **purpurascens** (Miyabe & Tatewaki) Hara in Rhod. **44:** 20 (1942). See also Fernald in Rhod. **43:** 156 (1941).

*Chamaepericlymenum canadense* forma *purpurascens* Miyabe & Tatewaki in Trans. Sapporo Nat. Hist. Soc. **15:** 43 (1937).

In willow-birch scrub along stream in upper valley of Frost Cr., north of Brintnell L., alt. 4000′, *9506.*

Common in this situation but not observed elsewhere; in flower July 18. This material is peculiar in having the pink color of the bracts arranged in longitudinal streaks, sometimes from near the base. Occasional plants have the leaves scattered down the stem, suggesting var. *intermedia* Farr, but nearly all of them have only one whorl of leaves.

**Cornus stolonifera** Michx. Fl. Bor.-Am. **1:** 92 (1803); Macoun, Cat. Can. Pl. Pt. 1: 191 (1883); Preble in N. Am. Fauna **27:** 530 (1908); Raup in Jour. Arn. Arb. **17:** 281 (1936); Porsild in Sargentia **4:** 57 (1943).

*Cornus alba* sensu Hooker, Fl. Bor.-Am. **1:** 276 (1834), in part, non L.

Providence, *Preble & Cary 48* (US); Simpson, *Hardisty* (N); same place, *Miss E. Taylor 6* (Can.); thickets near Simpson, shrubs up to 6′ high, *9855;* Bear R., *Miss E. Taylor 74* (Can.); along dry gully on south-facing slope of granite mountain west of Brintnell L., shrubs up to 5′ high, *9475.*

Common in the lowlands and occasional in the mountains; in flower at Brintnell L. about mid-July, and with ripe fruit at Simpson the last of August. Preble states that it is "a conspicuous shrub along streams throughout the wooded country," and in Fl. Bor.-Am. it is said to range northward to lat. 69°. Porsild, however, appears to be doubtful whether it extends to the lower Mackenzie, and suggests that Hooker's "69°" is a misprint for 59°.

The plants from Simpson and Brintnell L. have somewhat woolly inflorescences, thus suggesting var. *Baileyi* (Coult. & Evans) Drescher; but the hairs on the lower surfaces of the leaves are nearly all appressed as in the typical form.

## PYROLACEAE

**Moneses uniflora** (L.) Gray, Man. ed. 1: 273 (1848); Macoun, Cat. Can. Pl. Pt. 2: 306 (1884); Raup in Jour. Arn. Arb. **17**: 281 (1936); Porsild in Nat. Mus. Can. Bull. **101**: 24 (1945).

*Pyrola uniflora* L. Sp. Pl. 397 (1753); Hooker, Fl. Bor.-Am. **2**: 45 (1834).

Little Buffalo R., *Russell 68* (G); Great Slave L., *R. Bell 23203* (Can.); southwest and north shores of Great Slave L., *Howe 91962* (Can.); Windy Pt., Great Slave L., *Hume 102676* (Can.); Rae, *Russell* (Can.); Mackenzie R., *Kennicott* (N), and *Onion* (N); Liard R. between Nahanni Butte and Simpson, *Crickmay 95* (Can.); Wrigley, *Miss E. Taylor 17* (Can.), *31* (G, N); lowland woods and thickets near west end of Brintnell L., *9463.*

Common; collected in flower July 10 at Brintnell L. Observed by Porsild along the Canol Rd. at a tributary of Godlin R., mi. 168 E. Noted in Fl. Bor.-Am. ". . . throughout Canada to lat. 64°."

**Pyrola minor** L. Sp. Pl. 396 (1753); Porsild in Sargentia **4**: 57 (1943), in Nat. Mus. Can. Bull. **101**: 24 (1945).

Along small brook on west slope of Terrace Mt., north of Brintnell L., *9540.*

Apparently rare in this area; collected in flower July 18. Porsild notes it as common in Macmillan Pass, along the Canol Rd. It has been found at L. Athabaska, Great Bear L., the Mackenzie delta, and in the Richardson Mts.

**Pyrola secunda** L. Sp. Pl. 396 (1753); Hooker, Fl. Bor.-Am. **2**: 45 (1834); Macoun, Cat. Can. Pl. Pt. 2: 304 (1884); Raup in Jour. Arn. Arb. **17**: 282 (1936); Porsild in Nat. Mus. Can. Bull. **101**: 32 (1945).

Little Buffalo R., *Russell 71* (G); Great Slave L., *Kennicott* (N); northwest shore of Great Slave L., *Bedford* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 93* (Can.); Wrigley and vicinity, *Miss E. Taylor 34, 84, 85* (Can.); Norman, *Dutilly 40* (G); woods and thickets in lowland at west end of Brintnell L., *9462;* turfy shale slope on north side of Colonel Mt., alt. 4000′, *9653;* north peak of Nahanni Mt., *Wynne-Edwards 8496* (Can.).

Common in lowland woods, and occasional in alpine meadows up to 5000′–5500′ at Brintnell L.; in flower the second week in July. Some of the Brintnell L. plants appear to be intermediate between the typical form and the following variety.

**Pyrola secunda** L. var. **obtusata** Turcz. Fl. Baical.-Dahur. **2**[1]: 213 (1856); Porsild in Sargentia **4**: 57 (1943), in Nat. Mus. Can. Bull. **101**: 24 (1945). See also Rhod. **41**: 274 (1939).

Sekwi R., Canol Rd., mi. 174 E., *Porsild 11875* (Can.); Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11253* (Can.).

Porsild states that this is the prevailing form of the species in Keewatin and northern Mackenzie. It also appears occasionally in exposed situations in the Athabaska–Great Slave L. region. Intermediates between species and variety are frequent, often with the characters of both appearing on the same plant.

**Pyrola virens** Schweigg. in Schweigg. & Koerte, Fl. Erlang. **1**: 154 (1804). See Fernald in Rhod. **43**: 167 (1941).

*Pyrola chlorantha* Sw.; Hooker, Fl. Bor.-Am. **2**: 46 (1834); Macoun, Cat. Can. Pl. Pt. 2: 304 (1884); Raup in Jour. Arn. Arb. **17**: 282 (1936); Porsild in Sargentia **4**: 57 (1943).

Great Slave L., *Richardson* (G); northwest shore of Great Slave L., *Bedford* (Can.); Wrigley, *Miss E. Taylor 31* (Can.), *33* (G); Bear Rock, Norman, *Porsild 3389* (Can.); lowland woods near west end of Brintnell L., *9435*.

Common in low woods; in flower at Brintnell L. the second week in July. Noted in Fl. Bor.-Am. as occurring northward to Great Bear L., where Porsild has collected it in recent years. The latter has found it along the Mackenzie northward at least to Sans Sault Rapid.

**Pyrola grandiflora** Radius, Diss. Pyrola 27 (1821); Raup in Jour. Arn. Arb. **17**: 282 (1936); Porsild in Nat. Mus. Can. Bull. **101**: 24, 32 (1945).

*Pyrola rotundifolia* sensu Hooker, Fl. Bor.-Am. **2**: 46 (1834), in part; Macoun, Cat. Can. Pl. Pt. 2: 305 (1884), in part; non L.

Slave R., *Richardson* (G); southwest and north shores of Great Slave L., *Howe 91963* (Can.); Summit of Lone Mt., *Wynne-Edwards 8495* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8353* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11874* (Can.).

**Pyrola grandiflora** Radius var. **canadensis** (Andres) A. E. Porsild in Rhod. **41**: 273 (1939).

*Pyrola canadensis* Andres in Oest. Bot. Zeit. **63**: 250 (1913).

*Pyrola borealis* Rydb. in N. Am. Fl. **29**: 24 (1914).

*Pyrola rotundifolia* sensu Hooker, Fl. Bor.-Am. **2**: 46 (1834), in part; Macoun, Cat. Can. Pl. Pt. 2: 305 (1884), in part; non L.

Fort Smith, *Miss E. Taylor* (Can.); Rae, *Russell* (Can.); Mackenzie R., *Onion* (N) (type of *P. borealis*); damp lowland woods near Simpson, *9096;* Bear Rock, Norman, *Hume 103428* (Can.); mossy woods on shore of Brintnell L., *9181*.

Common; collected in flower at Simpson on June 11, and at Brintnell L. on June 20.

**Pyrola asarifolia** Michx. Fl. Bor.-Am. **1**: 251 (1803); Raup in Jour. Arn. Arb. **17**: 283 (1936).

Fort Smith, *Raup 1111*.

This typical form of the species is common in the southern part of the Mackenzie basin and is known in our region just at the southeastern corner.

**Pyrola asarifolia** Michx. var. **incarnata** (DC.) Fernald in Rhod. **6**: 178 (1904); Raup in Jour. Arn. Arb. **17**: 283 (1936); Porsild in Nat. Mus. Can. Bull. **101**: 24, 32 (1945).

*Pyrola rotundifolia* L. var. *incarnata* DC. Prodr. **7**: 773 (1839); Hooker, Fl. Bor.-Am. **2**: 46 (1834); Macoun, Cat. Can. Pl. Pt. 2: 305 (1884).

*Pyrola incarnata* Fisch. ex DC., as syn.

Liard R. between Nahanni Butte and Simpson, *Crickmay 94* (Can.); lowland woods and thickets near west end of Brintnell L., *9461;* along Frost Cr., in upper valley north of Brintnell L., alt. 4000′, *9274;* turfy east slope of Red Mt., alt. 5500′, *9737;* north peak of Nahanni Mt., *Wynne-Edwards 8494* (Can.); Nahanni Mts., *Preble & Cary 64* (US); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8354* (Can.); Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11254* (Can.).

Common in lowland woods at Brintnell L., but only occasional at higher levels; found flowering in late June and early July. Our no. *9737* has deep pink to red petals, purplish or brownish anthers, and a relatively short, slightly depressed style; furthermore it was found in flower much later in the season (Aug. 7). In some ways it seems intermediate between this species and *P. minor,* and it is left here tentatively. Its calyx and corolla closely resemble those of *P. asarifolia* var. *incarnata.*

**Monotropa uniflora** L. Sp. Pl. 387 (1753); Raup in Jour. Arn. Arb. **17:** 283 (1936).

The presence of *Monotropa uniflora* in southwestern Mackenzie is uncertain. It was not found anywhere in the Mackenzie basin by the earlier collectors until Miss Elizabeth Taylor collected it in 1892. Her labels (specimens in Herbs. G. and Can.) read simply "Slave River," with no indication as to where on the Slave River she found her specimens. It was not collected again until 1935, when we got it near Chipewyan and on the south shore of L. Athabaska.

## ERICACEAE

**Ledum groenlandicum** Oeder, Fl. Dan. *pl. 567* (1771); Preble in N. Am. Fauna **27:** 530 (1908); Raup in Jour. Arn. Arb. **17:** 283 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 24 (1945).

*Ledum palustre* L. var. *latifolium* (Ait.) Michx. sensu Hooker, Fl. Bor.-Am. **2:** 44 (1834).

*Ledum latifolium* Ait.; Macoun, Cat. Can. Pl. Pt. 2: 301 (1884).

Smith Portage, *Miss E. Taylor 59851* (Can.); 12 mi. east of Moraine Pt., Great Slave L., *Bedford* (Can.); southwest and north shores of Great Slave L., *Howe 91964* (Can.); east shore of Trout L., *C. O. Hage* (G); Mackenzie R., *Onion* (N); mossy banks along shore of Brintnell L., *9187;* turfy slope near summit of Red Mt., alt. 5500′–5900′, *9740;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11257* (Can.).

Common to abundant in timbered muskegs throughout the region. At Brintnell L. it is abundant in the open timber on the north slope of Colonel Mt. nearly to timber line, and it is occasional in the high tundra. In flower in late June.

**Ledum palustre** L. var. **decumbens** Ait. Hort. Kew. **2:** 65 (1789); Raup in Jour. Arn. Arb. **17:** 284 (1936).

*Ledum palustre* L., sensu Preble in N. Am. Fauna **27:** 531 (1908).

*Ledum decumbens* (Ait.) Lodd. ex Steud.; Porsild in Nat. Mus. Can. Bull. **101:** 24 (1945).

South shore of Great Slave L., *Brooke* (Can.); Mackenzie R., *Onion* (N); Liard R. between Nahanni Butte and Simpson, *Crickmay 90* (Can.); Mackenzie R. between Blackwater R. and Norman, *Crickmay 170* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alpine slope, alt. 5000′, *Wynne-Edwards 8357* (Can.); Trout Cr., Canol Rd., mi. 118 E., *Porsild 11836* (Can.).

Preble notes this species as occurring "On the Barren Grounds and in the northern part of the wooded country." I have collected it as far south in the Mackenzie basin as the northwest shore of L. Athabaska.

**Rhododendron lapponicum** (L.) Wahl. Fl. Suec. 249 (1824); Preble in N. Am. Fauna **27:** 531 (1908); Raup in Jour. Arn. Arb. **17:** 284 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 25, 32 (1945).

*Azalea lapponica* L. Sp. Pl. 151 (1753).

Liard R. between Nahanni Butte and Simpson, *Crickmay 87* (Can.); Lone Mt., *Wynne-Edwards 8497* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alpine slope, alt. 5000′, *Wynne-Edwards 8358* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11877* (Can.).

An arctic species which comes southward only a short distance into the forest.

**Loiseleuria procumbens** (L.) Desv. in Jour. Botanique **3**: 35 (1813); Raup in Jour. Arn. Arb. **17**: 284 (1936); Porsild in Sargentia **4**: 57 (1943), in Nat. Mus. Can. Bull. **101**: 25 (1945).

*Azalea procumbens* L. Sp. Pl. 151 (1753).

Liard R. between Nahanni Butte and Simpson, *Crickmay 92* (Can.); Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11260* (Can.).

An arctic species which has been collected by Porsild also in Keewatin, at Great Bear L., and in the Richardson Mts.

**Phyllodoce empetriformis** (Sm.) D. Don in Edinb. New Philos. Jour. **17**: 160 (1834); Porsild in Nat. Mus. Can. Bull. **101**: 25 (1945).

*Menziesia empetriformis* Sm. in Trans. Linn. Soc. **10**: 380 (1811).

Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11259* (Can.).

A Pacific slope species which apparently extends eastward only to the Yukon–Mackenzie divide.

**Phyllodoce glanduliflora** (Hook.) Cov. in Mazama **1**: 196 (1897).

*Menziesia glanduliflora* Hooker, Fl. Bor.-Am. **2**: 40 (1834).

Turfy east and northeast slopes of Red Mt., north of Brintnell L., alt. 4500′–5000′, *9277, 9749.*

Abundant on the above site, and extending up to the summit of Red Mt.; but only rare or occasional elsewhere on the mountains north of the lake, and not seen at all south of the lake. Collected in flower late in June, and with maturing fruit early in August.

**Kalmia polifolia** Wang. in Beob. Ges. Nat. Freunde Berlin **2**: 130 (1788); Raup in Jour. Arn. Arb. **17**: 284 (1936); Porsild in Sargentia **4**: 57 (1943), in Nat. Mus. Can. Bull. **101**: 25 (1945).

*Kalmia glauca* Ait.; Hooker, Fl. Bor.-Am. **2**: 41 (1834); Macoun, Cat. Can. Pl. Pt. 2: 300 (1884); Preble in N. Am. Fauna **27**: 531 (1908).

Resolution, *Kennicott* (N); Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11258* (Can.).

The range of *Kalmia polifolia* in the Mackenzie basin is not clearly defined, but it appears to be most abundant near and on both sides of the arctic timber line. It is occasional on the shores of L. Athabaska, but has not been collected around the eastern arm of Great Slave L. It has been found at Great Bear L. and in the Keewatin District by Porsild. In Fl. Bor.-Am. it is noted as ". . . extending beyond the woody regions, but scarcely, I believe, to the Arctic Circle"; and Preble states that it was ". . . noted south of Smith Landing [Fitzgerald] . . ." It apparently extends north to the Barren Grounds. Porsild says it is "A plant of northern muskegs that in Keewatin extends some distance beyond the limit of trees; rare in the lower Mackenzie basin, north to Bear Lake and in Central Yukon."

**Cassiope tetragona** (L.) D. Don in Edinb. New Philos. Jour. **17**: 158 (1834); Macoun, Cat. Can. Pl. Pt. 2: 297 (1884); Raup in Jour. Arn. Arb. **17**: 285 (1936); Porsild in Nat. Mus. Can. Bull. **101**: 25, 32 (1945).

*Andromeda tetragona* L. Sp. Pl. 393 (1753); Hooker, Fl. Bor.-Am. **2**: 38 (1834).

Mossy banks on south shore of Brintnell L., *9340;* northeast slope of Red Mt., alt. 5000′–5500′, *9295;* north peak of Nahanni Mt., *Wynne-Edwards 8498* (Can.); Lone Mt., *Wynne-Edwards 8499* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8355, 8356* (Can.).

Abundant on alpine slopes, where it is a primary part of the plant cover in many places. On the north slope of Colonel Mt. it extends down through the open timber to the shore of the lake; but it is rare on the southward-facing slopes

of Red Mt. In addition to the Canol Rd. localities mentioned above, Porsild reports it as common on the Plains of Abraham and in Macmillan Pass.

**Cassiope saximontana** Small in N. Am. Fl. **29**: 59 (1914).

Liard R. between Nahanni Butte and Simpson, *Crickmay 86* (Can.).

This appears to be a northeastern range extension for an otherwise Rocky Mountain and upper Yukon species.

**Andromeda Polifolia** L. Sp. Pl. 393 (1753); Hooker, Fl. Bor.-Am. **2**: 38 (1834); Macoun, Cat. Can. Pl. Pt. 2: 297 (1884); Preble in N. Am. Fauna **27**: 532 (1908); Raup in Jour. Arn. Arb. **17**: 285 (1936); Porsild in Nat. Mus. Can. Bull. **101**: 25, 32 (1945).

Resolution, *Kennicott* (N); southwest and north shores of Great Slave L., *Howe 91965* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Mackenzie R., *Onion* (N); north of the height of land between Great Slave and Great Bear Lakes, *Bedford* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 89* (Can.); muskeg along Willow Lake R., 60 mi. above mouth, *Crickmay 21* (Can.); mossy banks on shores of Brintnell L., *9185, 9252, 9327;* north peak of Nahanni Mt., *Wynne-Edwards 8500* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alpine slope, alt. 5000′, *Wynne-Edwards 8359* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11876* (Can.).

Occasional to common; collected in flower the last week of June. Noted in Fl. Bor.-Am. northward ". . . to the Arctic sea-shore"; and by Preble ". . . from Great Slave Lake northward. . . ." It is common in muskegs throughout the pre-Cambrian parts of the Athabaska–Great Slave L. region.

**Chamaedaphne calyculata** (L.) Moench, Meth. 457 (1794); Preble in N. Am. Fauna **27**: 532 (1908); Raup in Jour. Arn. Arb. **17**: 285 (1936); Porsild in Sargentia **4**: 58 (1943).

*Andromeda calyculata* L. Sp. Pl. 394 (1753); Hooker, Fl. Bor.-Am. **2**: 39 (1834).

*Cassandra calyculata* (L.) D. Don.; Macoun, Cat. Can. Pl. Pt. 2: 296 (1884).

Resolution, *Kennicott* (N); northwest shore of Great Slave L., *Bedford* (Can.); north of the height of land between Great Slave and Great Bear Lakes, *Bedford* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 88* (Can.); upland muskeg west of the Mackenzie R. near Simpson, *9926;* muskeg along Willow Lake R., 60 mi. above mouth, *Crickmay 22* (Can.).

Common at the Simpson station; found with mature fruit late in August. Preble reports it at Norman, and Porsild has collected it at Great Bear L., in the Eskimo Lakes basin, and in the Richardson Mts.

**Arctostaphylos Uva-ursi** (L.) Spreng. Syst. **2**: 287 (1825); Macoun, Cat. Can. Pl. Pt. 2: 295 (1884); Preble in N. Am. Fauna **27**: 532 (1908); Raup in Jour. Arn. Arb. **17**: 285 (1936); Porsild in Nat. Mus. Can. Bull. **101**: 25 (1945).

*Arbutus Uva-ursi* L. Sp. Pl. 395 (1753); Hooker, Fl. Bor.-Am. **2**: 37 (1834).

Fort Smith, *Seton & Preble 78352* (Can.); Resolution, *Kennicott* (N); southwest and north shores of Great Slave L., *Howe 91968* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); east shore of Trout L., *C. O. Hage* (G); Mackenzie R., *Onion* (N); stony fan on south shore of Brintnell L., *9579;* Nahanni Mts., *Preble & Cary 76* (US).

Common on dry stony fans at Brintnell L., and on warm south-facing slopes up to timber line; fruit mature in late summer. Porsild noted the species as common along a small tributary of Keele R., on the Canol Rd., mi. 51 E. In Fl. Bor.-Am. it is said to extend northward ". . . as far as Fort Franklin on the Mackenzie River"; but Preble says he saw it ". . . throughout the territory covered by our observations, and . . . also into the Barren Grounds."

Most of the plants in the Brintnell L. area represent the typical form, but no. *9579* may be referred provisionally to var. *adenotricha* Fernald & McBr. (in

Rhod. **16**: 211–213). It is somewhat more long-hirsute than this variety, however, and rather less glandular.

**Arctostaphylos alpina** (L.) Spreng. Syst. **2**: 287 (1825); Macoun, Cat. Can. Pl. Pt. 2: 294 (1884), in part; Porsild in Sargentia **4**: 58 (1943), in Nat. Mus. Can. Bull. **101**: 25 (1945).

*Arbutus alpina* L. Sp. Pl. 395 (1753); Hooker, Fl. Bor.-Am. **2**: 37 (1834), in part.

*Mairainia alpina* (L.) Desv.; Preble in N. Am. Fauna **27**: 532 (1908), in part.

This typical, black-berried form of the species was noted as common in Macmillan Pass by Porsild. It was observed by Preble at Great Bear L.; and more recently Porsild has reported it in Keewatin, at Great Bear L., in the Eskimo Lakes Basin, and the Mackenzie R. delta. Farther south in the Mackenzie basin it seems to be replaced entirely by the following red-fruited species.

**Arctostaphylos rubra** (Rehder & Wils.) Fernald in Rhod. **16**: 32 (1914); Raup in Jour. Arn. Arb. **17**: 286 (1936); Porsild in Sargentia **4**: 58 (1943), in Nat. Mus. Can. Bull. **101**: 25 (1945).

*Arctous alpina* (L.) Niedzu var. *ruber* Rehder & Wils. in Sargent, Pl. Wils. **3**: 556 (1913).

*Arbutus alpina* L.; Hooker, Fl. Bor.-Am. **2**: 37 (1834), in part.

*Mairainia alpina* (L.) Desv.; Preble in N. Am. Fauna **27**: 532 (1908), in part.

*Arctostaphylos alpina* (L.) Spreng.; Macoun, Cat. Can. Pl. Pt. 2: 294 (1884), in part.

Southwest and north shores of Great Slave L., *Howe 91967* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); woods near Simpson, *Crickmay 41* (Can.); "River-between-two-mountains," just west of Franklin Mts., *Crickmay 11* (Can.); gravelly thickets and lowland woods near west end of Brintnell L., *9450;* sphagnum hummocks in muskeg near east end of Brintnell L., *9594*.

Common to abundant in the Brintnell L. habitats mentioned, and extending up through the open timber on the north-facing slope of Colonel Mt. into the alpine meadows. The fruit turns red about mid-July in that area. Porsild reports the species as only occasional in Macmillan Pass, along the Canol Rd. This is the common form in the Athabaska–Great Slave L. region, and Porsild states that it is also common on the Arctic coast and at Great Bear L.

**Vaccinium canadense** Kalm ex Richardson, Bot. App. Frankl. Journ. 736 (1823); Hooker, Fl. Bor.-Am. **2**: 32 (1834); Macoun, Cat. Can. Pl. Pt. 2: 290 (1884); Preble in N. Am. Fauna **27**: 533 (1908); Raup in Jour. Arn. Arb. **17**: 286 (1936).

No specimens of this species are yet available from southwestern Mackenzie, though it undoubtedly extends at least into the country southwest of Great Slave L. It is abundant in many parts of the Wood Buffalo Park. Hooker gives its range as extending northward to Great Bear L., but there is no recent evidence that it goes that far. Preble did not report it north of Fitzgerald, on the Slave R.

**Vaccinium uliginosum** L. Sp. Pl. 350 (1753); Hooker, Fl. Bor.-Am. **2**: 32 (1834), in part; Macoun, Cat. Can. Pl. Pt. 2: 291 (1884), in part; Preble in N. Am. Fauna **27**: 533 (1908), in part; Raup in Jour. Arn. Arb. **17**: 286 (1936); Porsild in Nat. Mus. Can. Bull. **101**: 32 (1945).

Northwest shore of Great Slave L., *Bedford* (Can.); east shore of Trout L., *C. O. Hage* (G); Mackenzie R., *Onion* (N); mossy wooded bank on shore of Brintnell L., at Camp Pt., shrubs 2′ high, *9190;* Lone Mt., *Wynne-Edwards 8502* (Can.); Nahanni Mts., *Preble & Cary 69* (US).

Common at low altitudes throughout much of the region. Noted by Preble as ". . . the commonest blueberry throughout the region north to the Arctic Sea." This is true for southwestern Mackenzie, but hardly so for the whole Athabaska–

Mackenzie basin. *Vaccinium canadense* is probably the commonest form in the Athabaska country.

No doubt a series of transition forms between this and var. *alpinum* could be found, but they are sufficiently different in the Brintnell L. region, in habit, site-selection, and fruit, to warrant their separation. The typical form is an upright shrub growing at or near lake-level, and bearing an abundance of large juicy berries, while var. *alpinum* is a depressed shrub characteristic of high alpine situations, and bearing small berries. The typical form flowers in the third week of June and begins to mature its fruit about the first week in August. The berries vary greatly in shape from depressed spherical to spherical to pyriform or even cylindric.

**Vaccinium uliginosum** L. var. **alpinum** Bigel. Fl. Bost. ed. 2: 153 (1824); Porsild in Nat. Mus. Can. Bull. **101**: 25, 32 (1945).

Shale slide rock on west slope of Terrace Mt., alt. 6000′, depressed shrubs, *9511;* north peak of Nahanni Mt., *Wynne-Edwards 8501* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alpine bog, *Wynne-Edwards 8360* (Can.).

A primary part of the vegetation on high mountain slopes and summits, where it forms a large proportion of the plant cover, associated with *Dryas* and dwarf *Betula*. Collected in flower at 6000′ on July 18. Porsild reports it as common along the Canol Road.

**Vaccinium Vitis-Idaea** L. var. **minus** Lodd. Bot. Cab. *pl.* 1023 (1825); Raup in Jour. Arn. Arb. **17**: 287 (1936); Porsild in Nat. Mus. Can. Bull. **101**: 25 (1945).

*Vaccinium Vitis-Idaea* L. sensu Hooker, Fl. Bor.-Am. **2**: 34 (1834); Macoun, Cat. Can. Pl. Pt. 2: 293 (1884).

*Vitis-Idaea Vitis-Idaea* (L.) Britt. sensu Preble in N. Am. Fauna **27**: 532 (1908).

Fort Smith, *Seton & Preble 78384* (Can.); same place, *Miss E. Taylor 15459* (Can.); same place, *Raup 1194;* northwest shore of Great Slave L., *Bedford* (Can.); Old Ft. Rae, *Russell* (Can.); Wrigley Harbor, Great Slave L., *Kindle* (Can.); east shore of Trout L., *C. O. Hage* (G); rich woods along shore of Brintnell L., *9303.*

Common to abundant in woods and muskegs throughout the region. At Brintnell L. it reaches far above timber line, sometimes as much as 2000 feet. Porsild noted it as a dominant species in the heath at Macmillan Pass. In flower late in June.

**Vaccinium microcarpum** (Turcz. ex Rupr.) Hooker f. in Trans. Linn. Soc. **23**: 334 (1861).

*Oxycoccus microcarpus* Turcz. ex Rupr. in Beitr. z. Pflanzenk. des Russ. Reich **4**: 56 (1845); Porsild in Can. Field Nat. **52**: 117 (1938), in Sargentia **4**: 58 (1943), in Nat. Mus. Can. Bull. **101**: 25 (1945).

*Vaccinium Oxycoccus* sensu Hooker, Fl. Bor.-Am. **2**: 34 (1834), in part; Raup in Jour. Arn. Arb. **17**: 287 (1936); non L.

*Oxycoccus Oxycoccus* sensu Preble in N. Am. Fauna **27**: 533 (1908), non MacMill.

Southwest and north shores of Great Slave L., *Howe 91966* (Can.); near Rae, *Russell* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 91* (Can.); sphagnum hummocks in muskeg near east end of Brintnell L., *9593;* mossy banks in lower part of timber on north slope of Colonel Mt., *9415;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11256* (Can.).

Common in muskegs; in flower early in July and with ripening fruit in late July. Porsild states that it is mostly limited to the forested country in the Mackenzie basin, extending only a short distance beyond the tree line.

PRIMULACEAE

**Primula incana** M. E. Jones in Proc. Cal. Acad. II. **5**: 706 (1895); Fernald in Rhod. **30**: 72 (1928); Raup in Jour. Arn. Arb. **17**: 287 (1936); Porsild in Sargentia **4**: 59 (1943).

*Primula farinosa* sensu Hooker, Fl. Bor.-Am. **2**: 120 (1838), in part, non L.

Great Slave L., *Richardson* (G); Bear Rock, Norman, *Porsild 3390* (Can.).

Occasional to common in the Wood Buffalo Park, and probably also through the upper Mackenzie country. In Fl. Bor.-Am. *P. farinosa,* something of a mixture as treated there, was noted as occurring northward ". . . to lat. 66° on the Mackenzie River."

**Primula mistassinica** Michx. Fl. Bor.-Am. **1**: 124 (1803); Macoun, Cat. Can. Pl. Pt. 2: 309 (1884); Fernald in Rhod. **30**: 88 (1928); Raup in Jour. Arn. Arb. **17**: 288 (1936); Porsild in Nat. Mus. Can. Bull. **101**: 33 (1945).

*Primula Hornemanniana* sensu Hooker, Fl. Bor.-Am. **2**: 120 (1838), in part, non Lehm.

Southwest and north shores of Great Slave L., *Howe 91961* (Can.); Pine Pt., Great Slave L., *Brooke* (Can.); south bank of Mackenzie R., 10 mi. below Mills L., *Wynne-Edwards 8556* (Can.); Mackenzie R., *Richardson* (G); north of the height of land between Great Slave and Great Bear Lakes, *Bedford* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 96* (Can.); Willow Lake R., 80 mi. above mouth, *Crickmay 3* (Can.).

Common in the Athabaska–Great Slave L. country, and I have seen a specimen from Great Bear L. (*J. M. Bell,* Can.). All our specimens represent var. *typica* Fernald (l. c.).

**Primula egaliksensis** Wormsk. in Hornem. Fl. Dan. **9**: *t. 1511* (1816); Fernald in Rhod. **30**: 97 (1928); Raup in Jour. Arn. Arb. **17**: 288 (1936).

*Primula sibirica* sensu Hooker, Fl. Bor.-Am. **2**: 121 (1838), in large part; Macoun, Cat. Can. Pl. Pt. 2: 310 (1884), in part; non Jacq.

This species has not yet been collected in the upper Mackenzie region, though it is to be expected there. It is occasional on the eastern arm of Great Slave L., and has been collected at Great Bear L. by *J. M. Bell* (Can.). The range of *P. sibirica* is given in Fl. Bor.-Am. as "Barren country between lat. 60° and 69°, in clayey soil, by river banks and in marshy grounds."

**Primula stricta** Hornem. in Fl. Dan. **8**: *t. 1385* (1810); Fernald in Rhod. **30**: 66 (1928); Raup in Jour. Arn. Arb. **17**: 288 (1936); Porsild in Nat. Mus. Can. Bull. **101**: 35 (1945).

*Primula sibirica* sensu Hooker, Fl. Bor.-Am. **2**: 120 (1838), in small part, non Jacq.

South shore of Great Slave L., *R. Bell 23158* (Can.); Mackenzie R., *Richardson* (G); Providence, *Dutilly 65* (G); Smith Cr., about 13 mi. above Wrigley, *Crickmay 2* (Can.); Mackenzie R., 5 mi. above Old Fort Norman, *Wynne-Edwards 8563* (Can.); Bear R., *Miss E. Taylor 87* (Can.).

Apparently common or occasional along the Mackenzie from Great Slave L. northward. Also known on the arctic coast.

**Androsace septentrionalis** L. Sp. Pl. 142 (1753); Hooker, Fl. Bor.-Am. **2**: 119 (1838); Macoun, Cat. Can. Pl. Pt. 2: 311 (1884); Raup in Jour. Arn. Arb. **17**: 288 (1936).

Fort Smith, *Raup 1232, 3006;* Resolution, *Kennicott* (N); Mackenzie R., *Kennicott* (N); Simpson, *Onion, Kennicott & Hardisty* (N); south-facing slope in old field at Simpson, *9123.*

Common in the Simpson habitat mentioned above; in flower about mid-June. Its northward extent is given in Fl. Bor.-Am. as, ". . . to lat. 68° on the Mackenzie River," and I have seen a specimen from Good Hope (*Miss E. Taylor.* Can.).

**Androsace Chamaejasme** Host var. **arctica** Knuth in Pax & Knuth, in Pflanzenr. 22 (IV. 237): 190 (1905); Porsild in Nat. Mus. Can. Bull. **101**: 25, 32 (1945).

Liard R. between Nahanni Butte and Simpson, *Crickmay 97* (Can.); Norman, *Coll.?* (G); ? Cap Mt., near Wrigley, *R. A. Brooke* (Can.); north peak of Nahanni Mt., *Wynne-Edwards 8503* (Can.); Lone Mt., *Wynne-Edwards 8504* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alpine slope, *Wynne-Edwards 8361* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11878* (Can.).

A western arctic species, noted in Fl. Bor.-Am. as far south as Norman; but now known in the Mackenzie and Franklin Mts.

**Dodecatheon pauciflorum** (Durand) Greene in Pittonia **2**: 72 (1890); Raup in Jour. Arn. Arb. **17**: 288 (1936).

*Dodecatheon Meadia* L. var. *pauciflorum* Durand, Pl. Pratten. 95 (1855).

Junction of Nyarling and Little Buffalo Rivers, *Russell 1* (G); Resolution, *Kennicott* (N).

Abundant in the prairies of the Wood Buffalo Park; in flower about mid-June.

**Lysimachia thyrsiflora** L. Sp. Pl. 147 (1753); Hooker, Fl. Bor.-Am. **2**: 122 (1838); Macoun, Cat. Can. Pl. Pt. 2: 314 (1884); Raup in Jour. Arn. Arb. **17**: 288 (1936).

Sass Cr., *Russell 26* (G); Old Fort Rae, *Russell* (G).

Noted in Fl. Bor.-Am. as extending from ". . . Lake Huron to the Mackenzie River."

**Trientalis europaea** L. var. **arctica** (Fisch. ex Hooker) Ledeb. Fl. Ross. **3**: 25 (1851); Raup in Jour. Arn. Arb. **17**: 289 (1936).

*Trientalis arctica* Fisch. ex Hooker, Fl. Bor.-Am. **2**: 121 (1838).

Junction of Nyarling and Little Buffalo Rivers *Russell 57* (Can.).

This species is apparently common or abundant very locally in the Wood Buffalo Park, and has been collected also at Lesser Slave L. (*Brinkman 4023, 4279*, N) and near Waterways, Alta. (*Raup & Soper 9037*).

**Glaux maritima** L. Sp. Pl. 207 (1753); Raup in Jour. Arn. Arb. **17**: 289 (1936).

Junction of Nyarling and Little Buffalo Rivers, *Russell 72* (G); Sulfur Bay, Great Slave L., *Hume 102677* (Can.); Mackenzie R., *Kennicott* (N).

Common at the margins of saline flats in the Wood Buffalo Park; in flower about mid-June.

## PLUMBAGINACEAE

**Armeria maritima** Willd. var. **purpurea** (Koch) Lawrence in Gent. Herb. **4**: 405 (1940).

*Armeria vulgaris* Willd. ssp. *arctica* Hultén, sensu Porsild in Nat. Mus. Can. Bull. **101**: 25 (1945).

Liard R. between Nahanni Butte and Simpson, *Crickmay 98* (Can.); Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11819* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., wet alpine slope, alt. 5500', *Wynne-Edwards 8364* (Can.).

Porsild reports the species in flower late in July, and with mature fruit early in September.

## GENTIANACEAE

**Gentiana Amarella** L. Sp. Pl. 230 (1753); Raup in Jour. Arn. Arb. **17**: 290 (1936); Porsild in Sargentia **4**: 59 (1943).

*Gentiana acuta* Michx. sensu Griseb. in Hooker, Fl. Bor.-Am. **2**: 63 (1838).

*Gentiana Amarella* L. var. *acuta* (Michx.) Herder, sensu Macoun, Cat. Can. Pl. Pt. 2: 322 (1884).

Little Buffalo R., *Russell 45* (G); southwest and north shores of Great Slave L., *Howe 91959* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Rae, *Russell* (Can.);

Mackenzie R., *Onion* (N); along wood road near Simpson, *9883;* Mackenzie R. between Wrigley and Blackwater R., *Crickmay 136* (Can.); between Blackwater R. and Norman, *Crickmay 171* (Can.); Norman, *Coll.?* (N).

Apparently common in the upper Mackenzie valley. I have seen specimens from as far north as Good Hope (*Onion,* N), and Porsild has collected it at Great Bear L. Collected with late flowers and maturing capsules at Simpson Aug. 22.

**Gentiana propinqua** Richardson, Bot. App. Frankl. Journ. 734 (1823); Griseb. in Hooker, Fl. Bor.-Am. **2**: 62 (1838); Macoun, Cat. Can. Pl. Pt. 2: 322 (1884); Porsild in Nat. Mus. Can. Bull. **101**: 25, 32 (1945).

Liard R. between Nahanni Butte and Simpson, *Crickmay 99* (Can.); Mackenzie R., *Onion* (N); gravelly plains near west end of Brintnell L., *9460;* mossy banks on north shore of Brintnell L., *9347;* alpine meadows and turfy shale slopes on north side of Colonel Mt., alt. 4000′–6000′, *9642;* turfy alpine slopes of Red Mt., alt. 5000′, *9761;* Lone Mt., *Wynne-Edwards 8505* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alpine slope, alt. 5500′, *Wynne-Edwards 8363.*

Common in the Brintnell L. area; found flowering in late June and in July. Its range in Fl. Bor.-Am. is given as "Cumberland House to Bear Lake, and Bear Lake River."

**Gentiana arctophila** Griseb. in Hooker, Fl. Bor.-Am. **2**: 61 (1838); Porsild in Sargentia **4**: 59 (1943), in Nat. Mus. Can. Bull. **101**: 25 (1945).

Mossy banks on north shore of Brintnell L., *9161;* alpine meadows and turfy shale slopes on north side of Colonel Mt., alt. 5000′, *9417, 9608;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11262* (Can.).

Occasional in the Brintnell L. area, and apparently also on the Canol Rd.; in flower during late June and July. Our no. *9608* is an albino form with flowers greenish white or barely tinged with pink.

**Gentiana glauca** Pall. Fl. Ross. **2**: 104, *t. 93, f. 2* (1788); Porsild in Nat. Mus. Can. Bull. **101**: 25 (1945).

Northeast slope of Red Mt., alt. 5000′–5900′, *9291, 9735;* along small brook on west slope of Terrace Mt., alt. 5000′, *9543;* Bolstead Cr., Canol Rd., mi. 111 E., alpine slope, *Wynne-Edwards 8362* (Can.).

Common in the Brintnell L. localities cited above, but only occasional elsewhere in that area; found flowering in late June and mid-July, and fruiting early in August. Porsild reports it as common in Macmillan Pass.

**Gentiana Raupii** A. E. Porsild in Sargentia **4**: 60 (1943), in Nat. Mus. Can. Bull. **101**: 35 (1945).

*Gentiana detonsa* sensu Griseb. in Hooker, Fl. Bor.-Am. **2**: 64 (1838), non Fries.

*Gentiana serrata* sensu Macoun, Cat. Can. Pl. Pt. 2: 321 (1884), non Gunner.

*Gentiana elegans* sensu Raup in Jour. Arn. Arb. **17**: 290 (1936), non A. Nels.

Junction of Nyarling and Little Buffalo Rivers, *Russell 66* (G); southwest and north shores of Great Slave L., *Howe 91958* (Can.); Sulfur Bay, Great Slave L., *Hume 102678* (Can.); Mackenzie R., *Jones 62299* (Can.); same, *Onion* (N); Simpson, near sandy beach west of island, *Nowosad* (Can.); Mackenzie R. between Wrigley and Blackwater R., *Crickmay 137* (Can.); Blackwater R., *Porsild 6571* (TYPE); 5 mi. above Old Ft. Norman, *Wynne-Edwards 8564* (Can.); Norman, *Coll.?* (N); same place, *Kindle* (Can.); "Cumberland House to Bear Lake," *Richardson* (G).

**Lomatogonium rotatum** (L.) Fries ex Nyman, Consp. Fl. Eur. **3**: 500 (1881); Raup in Jour. Arn. Arb. **17**: 290 (1936); Porsild in Sargentia **4**: 60 (1943). See Fernald in Rhod. **21**: 193 (1919).

*Swertia rotata* L. Sp. Pl. 226 (1753).

*Pleurogyne rotata* (L.) Griseb.; Macoun, Cat. Can. Pl. Pt. 2: 325 (1884).

Little Buffalo R., *Russell 93* (G); Clewi R., *Russell 96* (G); southwest and north shores of Great Slave L., *Howe 91960* (Can.); Mackenzie R., *Onion* (N).

Apparently widespread in the Mackenzie basin, though not abundant in any one place. Porsild has collected it at Great Bear L. and on the arctic coast.

**Menyanthes trifoliata** L. Sp. Pl. 145 (1753); Macoun, Cat. Can. Pl. Pt. 2: 327 (1884); Raup in Jour. Arn. Arb. **17:** 290 (1936); Porsild in Sargentia **4:** 61 (1943). See Fernald in Rhod. **31:** 195 (1929).

Northwest shore of Great Slave L., *Bedford* (Can.); Mackenzie R., *Onion* (N); same, *Kennicott* (N).

Common in wet muskegs in the Athabaska–Great Slave L. region, and collected by Porsild at Great Bear L. and in the lower Mackenzie country.

## APOCYNACEAE

**Apocynum androsaemifolium** L. Sp. Pl. 213 (1753); Hooker, Fl. Bor.-Am. **2:** 51 (1838); Raup in Jour. Arn. Arb. **17:** 290 (1936).

Fort Smith, *Raup 1239* (*Mrs. Conibear,* coll.); northwest shore of Great Slave L., *Bedford* (Can.).

Noted in Fl. Bor.-Am. as occurring ". . . throughout the woody country," but I have seen no specimens from north of Great Slave L.

**Apocynum sibiricum** Jacq. Hort. Vind. **3:** 37, *pl. 66* (1776); Raup in Jour. Arn. Arb. **17:** 291 (1936). See Fernald in Rhod. **37:** 327 (1935).

Rocky-sandy bluff along Mackenzie R. opposite Simpson, *9941.*

Common in this habitat; collected Aug. 29, with fruit either fallen or not developed, and the leaves turned yellow. Not previously reported in the Mackenzie basin north of the Wood Buffalo Park, where it is only occasional.

## POLEMONIACEAE

**Polemonium acutiflorum** Willd. ex R. & S. Syst. **4:** 792 (1819); Porsild in Sargentia **4:** 61 (1943), in Nat. Mus. Can. Bull. **101:** 25 (1945).

Liard R. between Nahanni Butte and Simpson, *Crickmay 100* (Can.); thickets on old rock-slides in gorge, north slope of Colonel Mt., alt. 3300′, *9831;* willow-birch scrub, north slope of Colonel Mt., *9382;* birch scrub on northeast slope of Red Mt., alt. 4000′–5000′, *9292;* Bolstead Cr., Canol Rd., mi. 111 E., wet alpine slope, alt. 4700′, *Wynne-Edwards 8365* (Can.).

Common locally at Brintnell L., mostly confined to the willow-birch scrub zones on the mountains; found flowering in late June and early July; fruit mature in mid-August. Porsild reports it common in Macmillan Pass.

**Polemonium boreale** Adams. Mem. Soc. Nat. Mosc. **5:** 92 (1817); Porsild in Nat. Mus. Can. Bull. **101:** 25 (1945).

Bolstead Cr., Canol Rd., mi. 111 E., on high alpine ridge, alt. 6000′–7000′, *Wynne-Edwards 8366* (Can.).

Flowering specimens were gathered here on July 25.

**Collomia linearis** Nutt. Gen. **1:** 126 (1818); Hooker, Fl. Bor.-Am. **2:** 76 (1838); Macoun, Cat. Can. Pl. Pt. 2: 329 (1884); Raup in Jour. Arn. Arb. **17:** 291 (1936).

Mackenzie R., *? Richardson* (G); open field at Simpson, *9856.*

Common at Simpson; collected with mature fruit and occasional flowers Aug. 21. Noted in Fl. Bor.-Am., "From the Saskatchewan to Fort Frankin. . . ."

## HYDROPHYLLACEAE

**Phacelia Franklinii** (R. Br.) Gray, Man. ed. 2: 329 (1858); Macoun, Cat. Can. Pl. Pt. 2: 333 (1884); Raup in Jour. Arn. Arb. **17:** 291 (1936).

*Eutoca Franklinii* R. Br. in Richardson, Bot. App. Frankl. Journ. (Repr. 51) *t. 27* (1823); Hooker, Fl. Bor.-Am. **2**: 79 (1838).

Resolution, *Onion, Kennicott & Hardisty* (N); Windy Pt., Great Slave L., *Hume 102679* (Can.); Old Fort Rae, *Russell* (Can.); "Cumberland House to Bear Lake, June–Aug.," *Richardson* (G).

*Phacelia Franklinii* is common in clearings and natural openings in the Athabaska–Great Slave L. district. It is especially abundant as a fireweed in recently burned forest. In Fl. Bor.-Am. it is said to extend "From the Saskatchewan to the Bear Lake and English Rivers," but I have seen no specimens from beyond Great Slave L. except the Richardson collection with the somewhat equivocal label.

## BORAGINACEAE

**Lappula Redowskii** (Hornem.) Greene var. **occidentalis** (Wats.) Rydb. in Contr. U. S. Nat. Herb. **3**: 170 (1895); Raup in Jour. Arn. Arb. **17**: 291 (1936); Porsild in Sargentia **4**: 62 (1943).

*Echinospermum Redowskii* var. *occidentale* Wats. Bot. King Exped. 246, *t. 23, f. 9–10* (1871); Macoun, Cat. Can. Pl. Pt. *2*: 336 (1884).

*Echinospermum patulum* sensu Hooker, Fl. Bor.-Am. **2**: 84 (1838), at least in part, non Lehm.

Fort Smith, *Seton & Preble 78385* (Can.); on south-facing slope in old field at Simpson, *9122*.

Common around an old house site at Simpson, and at the edge of a cultivated field; collected in flower about mid-June. Noted in Fl. Bor.-Am. from "Cumberland House to Bear Lake," and collected in the Eskimo Lakes basin by Porsild.

**Myosotis alpestris** Schmidt ssp. **asiatica** Vesterg. in Hultén, Fl. Kamtch. **4**: 80 (1930); Porsild in Nat. Mus. Can. Bull. **101**: 25 (1945).

*Myosotis sylvatica* Hoffm. var. *alpestris* Koch, sensu Macoun, Cat. Can. Pl. Pt. *2*: 340 (1884).

Alpine meadows on south- and east-facing slopes of Red Mt., alt. about 5000′, *9202, 9294;* meadows on west slope of Terrace Mt., alt. 4800′–5500′, *9544;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11263* (Can.).

Common to abundant above timber line; in flower in late June and at least through mid-July. In Macoun's Catalogue there is a record for this species at the "Mackenzie River near Fort Simpson, Lat. 62° 30′ (*McGill Coll. Herb.*)."

**Mertensia paniculata** (Ait.) G. Don, Gen. Hist. **4**: 318 (1838); Macoun, Cat. Can. Pl. Pt. *2*: 339 (1884); Raup in Jour. Arn. Arb. **17**: 292 (1936); Williams in Ann. Mo. Bot. Gard. **24**: 42 (1937); Porsild in Sargentia **4**: 62 (1943), in Nat. Mus. Can. Bull. **101**: 25 (1945).

*Pulmonaria paniculata* Ait. Hort. Kew. **1**: 181 (1789).

*Lithospermum paniculatum* Lehm.; Hooker, Fl. Bor.-Am. **2**: 87 (1838).

Hay River, Great Slave L., *Preble & Cary 24* (US); same place, *Hume 102680* (Can.); east shore of Trout L., *C. O. Hage* (G); Mackenzie R., *Onion* (N); Simpson, *Onion* (N); gravelly thickets at Camp Pt., Brintnell L., *9261;* dry gravelly watercourse, north slope of Colonel Mt., alt. 5000′, *9647;* alpine meadows on south slope of Red Mt., *9218*.

Common to abundant, from low levels to high alpine meadows; in late June its blue flowers make banks of color on the high slopes. Porsild noted it as common in Macmillan Pass, and has collected it along the arctic coast of Yukon Territory. In Fl. Bor.-Am. its range is given as "Saskatchewan to Hudson's Bay and Bear Lake."

LABIATAE

**Scutellaria epilobiifolia** Hamilton, Monogr. Gen. Scut. 32 (1832); Raup in Jour. Arn. Arb. **17**: 292 (1936).

*Scutellaria galericulata* sensu Hooker, Fl. Bor.-Am. **2**: 114 (1838); Macoun, Cat. Can. Pl. Pt. 2: 388 (1884); non L.

Sass Cr., *Russell 16* (G); southwest and north shores of Great Slave L., *Howe 91955* (Can.); Mackenzie R., *Onion* (N), *Ross* (N), *Kennicott* (N); damp thicket along wood road near Simpson, *9880*.

Occasional; found with maturing fruit and a few flowers Aug. 22. Noted in Fl. Bor.-Am. ". . . as far north as Fort Franklin on the Mackenzie River."

**Dracocephalum parviflorum** Nutt. Gen. **2**: 35 (1818); Hooker, Fl. Bor.-Am. **2**: 115 (1838); Macoun, Cat. Can. Pl. Pt. 2: 387 (1884); Raup in Jour. Arn. Arb. **17**: 292 (1936).

Resolution, *Kennicott* (N); "Between Bear Lake and Cumberland House," *Richardson* (G).

Common in dry openings and clearings in the Wood Buffalo Park, and abundant in recently burned woods.

**Agastache Foeniculum** (Pursh) Ktze. Rev. Gen. Pl. 511 (1891); Raup in Jour. Arn. Arb. **17**: 292 (1936).

*Stachys Foeniculum* Pursh, Fl. Am. Sept. **2**: 407 (1814).

*Lophanthus anisatus* (Nutt.) Benth.; Hooker, Fl. Bor.-Am. **2**: 115 (1838); Macoun, Cat. Can. Pl. Pt. 2: 386 (1884).

Resolution, *Kennicott* (N).

The northern range of this species is given by Hooker as "Plains of Saskatchewan . . . to Fort Franklin on the Mackenzie River." In addition to the above specimen, however, I have seen it only at McMurray on the lower Athabaska R.

**Stachys palustris** L. var. **pilosa** (Nutt.) Fernald in Rhod. **45**: 474 (1943).

*Stachys pilosa* Nutt. in Jour. Acad. Phil. **7**: 48 (1834).

*Stachys palustris* L. sensu Hooker, Fl. Bor.-Am. **2**: 116 (1838); Macoun, Cat. Can. Pl. Pt. 2: 390 (1884); Porsild in Sargentia **4**: 62 (1943), in Nat. Mus. Can. Bull. **101**: 33 (1945).

*Stachys scopulorum* Greene; Raup in Jour. Arn. Arb. **17**: 293 (1936).

Junction of Nyarling and Little Buffalo Rivers, *Russell 67* (G); Resolution, *Onion, Kennicott & Hardisty* (N); Mackenzie R., *Onion, Kennicott & Hardisty* (N); south bank of Mackenzie R., 10 mi. below Mills L., *Wynne-Edwards 8554* (Can.); grassy swale near Ft. Liard, *Nowosad* (Can.); open field at Simpson, *9847;* rocky-sandy bank of Mackenzie R. opposite Simpson, *9954;* upland prairie west of Mackenzie R. near Simpson, *9893;* Mackenzie R. between Wrigley and Blackwater R., *Crickmay 140* (Can.).

Common to occasional in the upper Mackenzie valley; collected in fruit late in August. Noted in Fl. Bor.-Am., "Throughout Canada to Fort Franklin on the Mackenzie River."

**Mentha canadensis** L. var. **glabrata** Benth. in DC. Prodr. **12**: 173 (1848); Macoun, Cat. Can. Pl. Pt. 2: 381 (1884); Raup in Jour. Arn. Arb. **17**: 293 (1936).

*Mentha canadensis* L. var. *glabrior* Hooker, Fl. Bor.-Am. **2**: 111 (1838).

Northwest shore of Great Slave L., *Bedford* (Can.); Mackenzie R., *Onion* (N); Simpson, *Miss E. Taylor 119* (Can.); damp lowland thickets and sloughs near Simpson, *9843, 9879;* rocky-sandy bank of Mackenzie R. opposite Simpson *9955;* damp places in upland prairie west of Mackenzie R. near Simpson, *9921;* grassy swale near Ft. Liard, *Nowosad* (Can.).

Common in the Simpson area; collected in flower and with maturing fruit late in August. This is the commonest mint of the Athabaska–Great Slave L. region, but its northern limit in the Mackenzie valley is not yet known.

## SCROPHULARIACEAE

**Limosella aquatica** L. Sp. Pl. 631 (1753); Raup in Jour. Arn. Arb. **17:** 293 (1936); Porsild in Sargentia **4:** 62 (1943).

This species has not yet been found in southwestern Mackenzie, but it has been collected at Lake Athabaska and at Great Bear L. (Porsild, l. c.). Small and inconspicuous, it is easily overlooked.

**Veronica scutellata** L. Sp. Pl. 12 (1753); Raup in Jour. Arn. Arb. **17:** 294 (1936).

Near Fort Smith, *Raup 1252;* northwest shore of Great Slave L., *Bedford* (Can.).

**Veronica alpina** L. var. **alterniflora** Fernald in Rhod. **41:** 455, *t. 567* (1939); Porsild in Nat. Mus. Can. Bull. **101:** 25 (1945).

Noted by Porsild as common in Macmillan Pass, Canol Rd., mi. 225 E. Mr. Porsild apparently did not collect specimens in the Pass itself, but specimens from the Yukon side were determined as var. *alterniflora* by Fernald.

**Veronica alpina** L. var. **unalaschcensis** Cham. & Schl. in Linnaea **2:** 556 (1827); Porsild in Sargentia **4:** 62 (1943). See Fernald in Rhod. **41:** 450 (1939).

Willow-birch scrub and alpine meadows, upper valley of Frost Cr., and on west slope of Terrace Mt., north of Brintnell L., alt. 4000′–5500′, *9554.*

Common; observed also on the east slopes of Red Mt., but not on Colonel Mt.; in flower about mid-July.

Some of these plants approach var. *geminiflora* Fernald (In Rhod. **41:** 454). They have the short styles and rather elongate fruiting racemes of this variety, with the lowermost capsules sometimes opposite. Others have the close inflorescence of var. *unalaschcensis.*

**Veronica peregrina** L. var. **xalapensis** (H.B.K.) Pennell in Torreya **19:** 167 (1919); Raup in Jour. Arn. Arb. **17:** 294 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 33 (1945).

*Veronica xalapensis* H.B.K. Nov. Gen. & Sp. **2:** 389 (1818).

*Veronica peregrina* L. sensu Hooker, Fl. Bor.-Am. **2:** 101 (1838); Macoun, Cat. Can. Pl. Pt. 2: 362 (1884).

South bank of Mackenzie R., 10 mi. below Mills L., *Wynne-Edwards 8558* (Can.); sandy bank of Mackenzie R. opposite Simpson, *9939.*

Occasional at Simpson; found with mature capsules late in August. Its northern range is given in Fl. Bor.-Am. as "Throughout Canada to Mackenzie River."

**Euphrasia subarctica** Raup in Rhod. **36:** 87 (1934), in Jour. Arn. Arb. **17:** 294 (1936).

This species has been found at Lake Athabaska, on the eastern arm of Great Slave L., and in Alaska. Its occurrence in the upper Mackenzie valley is problematical, but it should be looked for in that region. In Fl. Bor.-Am., *E. officinalis* L. is said to range northward to lat. 64°, and it may be that part of the material upon which this range was based is *E. subarctica.* On the other hand Porsild (Sargentia **4:** 64) has collected specimens at Great Bear L. which he has named *E. disjuncta,* so that Hooker may have had both species in his concept of *E. officinalis.*

**Castilleja pallida** L. ssp. **caudata** Pennell in Proc. Acad. Nat. Sci. Phil. **86:** 524 (1934); Porsild in Sargentia **4:** 63 (1943), in Nat. Mus. Can. Bull. **101:** 32 (1945).

North Peak of Nahanni Mt., *Wynne-Edwards 8506* (Can.).

Previously collected in the Mackenzie basin only on Peel River and in the Mackenzie delta.

**Castilleja pallida** L. ssp. **elegans** (Malte) Pennell in Proc. Acad. Nat. Sci. Phil. **86:** 526 (1934); Porsild in Sargentia **4:** 63 (1943), in Nat. Mus. Can. Bull. **101:** 25 (1945).

*Castilleja elegans* Malte in Rhod. **36:** 187 (1934).

Bolstead Cr., Canol Rd., mi. 111 E., alpine slopes, *Wynne-Edwards 8375* (Can.).

An arctic subspecies, whose principal range is north of the tree line.

**Castilleja Raupii** Pennell in Proc. Acad. Nat. Sci. Phil. **86:** 528 (1934); Raup in Jour. Arn. Arb. **17:** 294 (1936); Porsild in Sargentia **4:** 63 (1943), in Nat. Mus. Can. Bull. **101:** 35 (1945).

Fort Smith, *Seton & Preble 78386* (Can.); same place, *Raup 1258;* lower Slave R., *Raup 1262;* southwest and north shores of Great Slave L., *Howe 91957* (Can.); Windy Pt., Great Slave L., *Hume 102682* (Can.); Pine Pt., Great Slave L., *Brooke* (Can.); near Rae, *Russell* (Can.); Hay River, *Preble & Cary 16* (US); Wrigley Harbor, Great Slave L., *Kindle* (Can.); east shore of Trout L., *C. O. Hage* (G); Mackenzie R., *Onion* (N); Liard R. between Nahanni Butte and Simpson, *Crickmay 101* (Can.); along wood roads around Simpson, *9088, 9143;* upland woods west of Mackenzie R. near Simpson, *9915;* Nahanni Mts., *Preble & Cary 71* (US).

Common in the Athabaska–Great Slave L. region and the upper Mackenzie valley; in flower about mid-June.

**Castilleja Raupii** Pennell ssp. **ursina** Pennell in Proc. Acad. Nat. Sci. Phil. **86:** 530 (1934); Porsild in Sargentia **4:** 64 (1943), in Nat. Mus. Can. Bull. **101:** 33, 34, 35 (1945).

South bank of Mackenzie R., 10 mi. below Mills L., *Wynne-Edwards 8557* (Can.); Wrigley, *Miss E. Taylor 35* (Can.); Saline R., above Norman, *Wynne-Edwards 8576* (Can.); Bear R., *Miss E. Taylor 86* (Can.) (TYPE).

Porsild has collected this subspecies in the Mackenzie delta, and Wynne-Edwards got it a few miles below Good Hope.

**Rhinanthus groenlandicus** Chab. in Bull. Herb. Boiss. **7:** 515 (1899); Porsild in Sargentia **4:** 64 (1943), in Nat. Mus. Can. Bull. **101:** 34, 35 (1945).

*Rhinanthus Crista-galli* sensu Hooker, Fl. Bor.-Am. **2:** 106 (1838); Macoun, Cat. Can. Pl. Pt. 2: 371 (1884); non L.

*Rhinanthus Kyrollae* Chab. sensu Raup in Jour. Arn. Arb. **17:** 294 (1936).

Rocky-sandy bank of Mackenzie R. opposite Simpson, *9936;* Wrigley, *Wynne-Edwards 8606* (Can.); Mackenzie R. between Wrigley and Blackwater R., *Crickmay 138* (Can.); along Mackenzie R. near Root R., *Porsild 6562* (Can.); 5 mi. above Old Fort Norman, *Wynne-Edwards 8565* (Can.).

Common locally at Simpson; collected in fruit late in August. The determination of our material is provisional, not only because of the incompleteness of the specimens (dry stems and capsules, but no leaves), but also because of uncertainty of the species limits within the genus. *Rhinanthus Crista-galli* is noted by Hooker as extending ". . . to the shores of the Slave Lake, and to Fort Franklin."

**Pedicularis labradorica** Wirsing, Ecolog. Bot. [2] *t. 10* (1778); Raup in Jour. Arn. Arb. **17:** 295 (1936), name wrongly attributed to Houttuyn; Porsild in Nat. Mus. Can. Bull. **101:** 26, 33 (1945). See Fernald in Rhod. **33:** 193 (1931); Merrill in Rhod. **40:** 292 (1938).

*Pedicularis euphrasioides* Stephan; Hooker, Fl. Bor.-Am. **2:** 109 (1838); Macoun, Cat. Can. Pl. Pt. 2: 368 (1884).

Windy Pt., Great Slave L., *Hume 102681* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Rae, *Russell* (Can.); Mackenzie R., *Onion* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 103* (Can.); outwash gravel plain near mouth of North Nahanni R., *Wynne-Edwards 8539* (Can.); Norman, *Dutilly 44* (G); upper slopes of Red Mt., north of Brintnell L., alt. 4000′–5000′, *9204, 9290;* Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8373* (Can.).

Occasional to common in the Brintnell L. district; found below timber line on the north slope of Colonel Mt.; in flower late in June. Noted in Fl. Bor.-Am., "North of the Saskatchewan to the Arctic Sea-shore." I have seen specimens from Great Bear L. (*J. M. Bell,* Can.) and the lower Mackenzie (*Miss E. Taylor,* Can.).

**Pedicularis sudetica** Willd. Sp. Pl. **3:** 209 (1800); Porsild in Nat. Mus. Can. Bull. **101:** 26 (1945).

Swampy muskeg thickets around the shores of Brintnell L., *9192, 9235, 9326;* Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11820* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., wet alpine slopes, alt. 5000′, *Wynne-Edwards 8370, 8371, 8372* (Can.).

Occasional in the Brintnell L. habitat noted, though widespread around the lake; found flowering in late June.

**Pedicularis lanata** Cham. & Schl. in Linnaea **2:** 583 (1827); Porsild in Nat. Mus. Can. Bull. **101:** 26, 32 (1945).

Liard R. between Nahanni Butte and Simpson, *Crickmay 102* (Can.); alpine meadows and turfy ledges, north slope of Colonel Mt., *9401;* summit and higher alpine slopes of Red Mt., *9201, 9762;* Nahanni Mts., *Preble 315* (US); Lone Mt., *Wynne-Edwards 8507* (Can.); north peak of Nahanni Mt., *Wynne-Edwards 8508* (Can.); Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11821* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alpine slope, alt. 5000′, *Wynne-Edwards 8369* (Can.).

Common in the Brintnell L. area; collected in flower June 21, and with maturing capsules early in August.

**Pedicularis arctica** R. Br. in Suppl. App. Parry's 1st Voy. 280 (1824), Chlor. Melv. 32 (1824); Porsild in Nat. Mus. Can. Bull. **101:** 26 (1945). See Porsild in Sargentia **4:** 64 (1943).

Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11822* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alpine slope, alt. 5000′–6000′, *Wynne-Edwards 8367, 8368* (Can.).

**Pedicularis parviflora** Smith in Rees, Cycl. **26** (1813); Raup in Jour. Arn. Arb. **17:** 295 (1936).

This species is included here provisionally. It is a western arctic and north Pacific coast species which I collected at Lake Athabaska in 1935 (l. c.), thus greatly extending its known range. In Macoun's Catalogue of Canadian Plants (Pt. 2: 369, 1884), under *P. palustris* L. var. *Wlassoviana* Bunge, is the note "On the Mackenzie River. (*McGill Coll. Herb.*)." Other than my own collection this is the only indication we have of *P. parviflora* in the Mackenzie basin. It suggests, however, that the plant may occur somewhere in the Mackenzie valley.

**Pedicularis capitata** Adams in Mém. Soc. Nat. Mosc. **5:** 100 (1817); Porsild in Nat. Mus. Can. Bull. **101:** 26 (1945).

Mackenzie R., *Jones 62305* (Can.); mossy bank on south shore of Brintnell L., *9357;* in willow-birch scrub above timber line on north slope of Colonel Mt., *9378;* Bolstead Cr., Canol Rd., mi. 111 E., alpine slope, *Wynne-Edwards 8374* (Can.).

At Brintnell L. this species was seen only on the mountain sides south of the lake, where it was common; found flowering early in July.

## OROBANCHACEAE

**Boschniakia rossica** (Cham. & Schl.) Fedtch. in Fedtch. & Flerov. Fl. Eur. Ross. 896 (1910); Raup in Jour. Arn. Arb. **17:** 295 (1936); Porsild in Sargentia **4:** 65 (1943), in Nat. Mus. Can. Bull. **101:** 33 (1945).

*Orobanche rossica* Cham. & Schl. in Linnaea **4:** 132 (1828).

*Orobanche glabra* Hooker, Fl. Bor.-Am. **2:** 91 (1838).

*Boschniakia glabra* (Hooker) C. A. Mey.; Macoun, Cat. Can. Pl. Pt. 2: 374 (1884).

Great Slave L., *R. Bell 23149* (Can.); Simpson, *Wynne-Edwards 8610* (Can.); willow-poplar-alder thickets near Simpson (under *Alnus crispa*), *9103;* Norman, *Dutilly 1* (G); mossy banks on south shore of Brintnell L. (under *Alnus crispa*), *9358;* in alder thickets on lower north slope of Colonel Mt., *9393.*

Common to abundant; in flower early in July. Noted in Fl. Bor.-Am. from "Great Slave Lake to Fort Franklin on the Mackenzie River." It appears to be common in woods and alder thickets, however, throughout the lower Mackenzie country. Porsild has collected it in the Mackenzie delta, in the Eskimo Lakes basin, and at Great Bear L.

## LENTIBULARIACEAE

**Pinguicula vulgaris** L. Sp. Pl. 17 (1753); Hooker, Fl. Bor.-Am. **2:** 118 (1838); Macoun, Cat. Can. Pl. Pt. 2: 376 (1884); Raup in Jour. Arn. Arb. **17:** 295 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 26, 32 (1945).

Southwest and north shores of Great Slave L., *Howe 91956* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Rae, *Russell* (Can.); Mackenzie R. between Wrigley and Blackwater R., *Crickmay 139* (Can.); Lone Mt., *Wynne-Edwards 8509* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8376* (Can.).

Noted in Fl. Bor.-Am. as occurring in "woody and barren territories to Mackenzie's River." The species is common around Great Slave L., and I have seen specimens from Great Bear L. (*J. M. Bell,* Can.) and Good Hope (*Miss E. Taylor,* G. Can.).

**Pinguicula villosa** L. Sp. Pl. 17 (1753); Raup in Jour. Arn. Arb. **17:** 296 (1936); Porsild in Sargentia **4:** 65 (1943).

On hummocks of *Sphagnum* in muskeg near eastern end of Brintnell L., *9595.*

Though widespread in northern Mackenzie, this species appears to be only occasional in occurence. At Brintnell L. it was common in the single spot noted, but was not seen elsewhere in that area. Porsild states that it is "Rare or occasional in sphagnum bogs of the wooded country north to the limit of trees or slightly beyond."

**Utricularia vulgaris** L. Sp. Pl. 18 (1753); Raup in Jour. Arn. Arb. **17:** 296 (1936).

*Utricularia vulgaris* L. var. *americana* Gray, sensu Porsild in Sargentia **4:** 66 (1943).

Grande Detour Portage, lower Slave R., *Russell 74* (G); northwest shore of Great Slave L., *Bedford* (Can.); Rae, *Russell* (Can.); near large lake between southern extremities of Franklin Mts., *Crickmay 34* (Can.).

Common to abundant in the Athabaska–Great Slave L. district, and probably far northward. Porsild has collected it in the Mackenzie delta, the Eskimo Lakes basin, and at Great Bear L.

Porsild, perhaps correctly, has assigned all the Mackenzie basin specimens to var. *americana* Gray (Man. ed. 5: 318, 1867). Northwestern American plants, however, approach the typical European, and since I have seen but little flowering material from the Mackenzie country I think it best at present to regard our plants as representing the species in its broad sense.

**Utricularia minor** L. Sp. Pl. 18 (1753); Raup in Jour. Arn. Arb. **17:** 296 (1936); Porsild in Sargentia **4:** 65 (1943).

This species has not been collected in the upper Mackenzie valley, though it is probably common there. I have collected it at Athabaska and Great Slave Lakes, and Porsild has it from several places around Great Bear L.

**Utricularia intermedia** Hayne in Schrad. Jour. Bot. **1800:** 18 (1801); Hooker, Fl. Bor.-Am. **2:** 118 (1838); Macoun, Cat. Can. Pl. Pt. 2: 375 (1884); Raup in Jour. Arn. Arb. **17:** 296 (1936); Porsild in Sargentia **4:** 65 (1943).

Not yet collected in the upper Mackenzie country, though it unquestionably is common there. Like so many aquatics it has been picked up by only a few collectors. It was noted in Fl. Bor.-Am. from "Lake Huron to Bear Lake," where Porsild has found it common. Porsild also has it, however, from the Mackenzie delta and from the Eskimo Lakes basin. It is occasional to common around Athabaska and Great Slave Lakes.

## PLANTAGINACEAE

**Plantago major** L. Sp. Pl. 112 (1753); Hooker, Fl. Bor.-Am. **2**: 123 (1838).

*Plantago major* L. var. *asiatica* (L.) Decaisne, sensu Macoun, Cat. Can. Pl. Pt. 2: 392 (1884); Raup in Jour. Arn. Arb. **17**: 296 (1936).

Fort Smith, *Raup 1294;* lowland woods near Simpson, *9089;* "To the Arctic Sea," *Richardson* (G).

Common at Simpson; in fruit late in August. Noted in Fl. Bor.-Am., "From Lake Huron . . . to lat. 68°." The relationship of the Mackenzie basin plants to the typical form is uncertain. In detailed structural characteristics they resemble the common weed of waste places very closely. In our region, however, their habit of growth and selection of habitats strongly suggest a native species. Their leaves usually are rather stiff and upright, and they appear in woods and thickets well away from much frequented paths.

**Plantago eriopoda** Torr. in Ann. Lyc. N. Y. **2**: 237 (1827); Raup in Jour. Arn. Arb. **17**: 296 (1936); Porsild in Sargentia **4**: 66 (1943).

*Plantago eriopoda* is common on saline flats in the Wood Buffalo Park, and it has been collected by Porsild on the arctic coast east of the Mackenzie delta. It has not been collected in southwestern Mackenzie, but undoubtedly occurs there, in areas watered by salt springs from the Silurian limestones.

**Plantago septata** Morris in Bull. N. Y. Bot. Gard. **2**: 182 (1901); Porsild in Sargentia **4**: 66 (1943), in Nat. Mus. Can. Bull. **101**: 33 (1945).

*Plantago lanceolata* L. var. β Hooker, Fl. Bor.-Am. **2**: 123 (1838).

Mackenzie R., *Onion* (G); Liard R. between Nahanni Butte and Simpson, *Crickmay 104* (Can.); Simpson, *Wynne-Edwards 8609* (Can.); Norman, *Dutilly 46* (G).

Noted in Fl. Bor.-Am. as occurring from "Fort Norman to Arctic Sea-shore," but we now have it considerably farther south, at Simpson and on the lower Liard R.

## RUBIACEAE

**Galium boreale** L. Sp. Pl. 108 (1753); Hooker, Fl. Bor.-Am. **1**: 289 (1834); Macoun, Cat. Can. Pl. Pt. 2: 203 (1884); Raup in Jour. Arn. Arb. **17**: 297 (1936); Porsild in Sargentia **4**: 66 (1943), in Nat. Mus. Can. Bull. **101**: 32, 34 (1945).

Fort Smith, *Raup 1304;* junction of Nyarling and Little Buffalo Rivers, *Russell 55* (G); Sulfur Bay, Great Slave L., *Hume 102685* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Old Fort Rae, *Russell* (Can.); Mackenzie R., *Onion, Kennicott & Hardisty* (N); Providence, *Preble & Cary 30* (US); Liard R. between Nahanni Butte and Simpson, *Crickmay 105* (Can.); open field at Simpson, *9848;* Saline R., above Norman, *Wynne-Edwards 8577* (Can.); Nahanni Mts., *Preble & Cary 54* (Can.); north peak of Nahanni Mt., *Wynne-Edwards 8510* (Can.).

Common; collected with flowers and maturing fruit Aug. 21. Hooker gives its range ". . . to lat. 68° North . . . ," and Porsild has collected it both in the Mackenzie delta and at Great Bear L. It is abundant in the central Mackenzie basin.

**Galium trifidum** L. Sp. Pl. 105 (1753); Macoun, Cat. Can. Pl. Pt. 2: 201 (1884); Raup in Jour. Arn. Arb. **17:** 297 (1936); Porsild in Sargentia **4:** 67 (1943), in Nat. Mus. Can. Bull. **101:** 26 (1945).

*Galium Claytoni* sensu Hooker, Fl. Bor.-Am. **1:** 288 (1834), in part, non Michx.

Fort Smith, *Raup 1304;* Little Buffalo R., *Russell 86* (G); damp place in upland prairie west of Mackenzie R. near Simpson, *9913;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11264* (Can.).

Common locally, north to Great Bear L. and the lower Mackenzie (Hooker, l. c.; Porsild, l. c.). Collected with mature fruit at Simpson late in August.

## CAPRIFOLIACEAE

**Viburnum edule** (Michx.) Raf. Med. Repos. Lex. II. **5:** 354 (1808); Hooker, Fl. Bor.-Am. **1:** 281 (1834), in part; Porsild in Sargentia **4:** 67 (1943). See Fernald in Rhod. **43:** 481 (1941).

*Viburnum Opulus* L. var. *edule* Michx. Fl. Bor.-Am. **1:** 18 (1803).

*Viburnum pauciflorum* Raf.; Macoun, Cat. Can. Pl. Pt. 2: 195 (1884); Preble in N. Am. Fauna **27:** 534 (1908); Raup in Jour. Arn. Arb. **17:** 297 (1936).

*Viburnum Oxycoccus* sensu Hooker, Fl. Bor.-Am. **1:** 281 (1834), in part, non Pursh.

Fort Smith, *Seton & Preble 78333* (Can.); same place, *Raup 1324;* Resolution, *Kennicott* (N); same place, *Preble 204* (US); same place, *Preble & Cary 152, 153* (US); Hay River, Great Slave L., *Preble & Cary 19* (US); northwest shore of Great Slave L., *Bedford* (Can.); east shore of Trout L., *C. O. Hage* (G); Mackenzie R., *Onion* (N); Simpson, *Onion, Kennicott & Hardisty* (N); damp lowland woods at Simpson, shrubs up to 6′ high, *9082;* Wrigley, *Preble & Cary 87* (US); rich spruce woods along shore of Brintnell L., shrubs up to 6′ high, *9498;* Nahanni Mts., alt. 700′ and 1500′, *Preble & Cary 59, 81* (US).

Common to abundant in woods throughout the Athabaska–Great Slave L. region and the upper Mackenzie country. Porsild states that it is only occasional along the lower Mackenzie and at Great Bear L. At Brintnell L. we found it in stunted form as high as 4100′ on the south slope of Terrace Mt. In flower at Simpson on June 11, and collected with unripe berries at Brintnell L. in mid-July.

**Symphoricarpos occidentalis** Hooker, Fl. Bor.-Am. **1:** 285 (1834); Macoun, Cat. Can. Pl. Pt. 2: 195 (1884); Raup in Jour. Arn. Arb. **17:** 298 (1936).

Resolution, *Kennicott* (N).

This species is noted in Fl. Bor.-Am. as occurring in the "Woody country between lat. 54° and 64°," but I have seen no material from north of Resolution. It is rather abundant in the drier prairies of the Wood Buffalo Park, and probably extends to similar situations along the upper Mackenzie.

**Symphoricarpos albus** (L.) Blake var. **pauciflorus** (Robbins) Blake in Rhod. **16:** 119 (1914); Raup in Jour. Arn. Arb. **17:** 298 (1936).

*Vaccinium album* L. Sp. Pl. **1:** 350 (1753), in part.

*Symphoricarpos racemosus* Michx. var. *pauciflorus* Robbins in Gray, Man. ed. 5: 203 (1867), in part; emend. Fernald in Rhod. **7:** 167 (1905).

Fort Smith, *Raup 1320;* Little Buffalo R., *Russell 102* (G).

Common to abundant in the open woods and prairies of the Wood Buffalo Park, and probably also in similar situations along the upper Mackenzie. It has not been collected, however, from beyond the lower Little Buffalo R.

**Linnaea borealis** L. var. **americana** (Forbes) Rehder in Rhod. **6:** 56 (1904); Raup in Jour. Arn. Arb. **17:** 298 (1936).

*Linnaea americana* Forbes, Hort. Woburn. 135 (1825).

*Linnaea borealis* L. sensu Hooker, Fl. Bor.-Am. **1:** 285 (1834); Macoun, Cat. Can. Pl. Pt. 2: 195 (1884).

Fort Smith, *Miss E. Taylor 9572* (Can.); same place, *Raup 1311;* Little Buffalo R., *Russell 69* (G); Windy Pt., Great Slave L., *Hume 102684* (Can.); southwest and north shores of Great Slave L., *Howe 91954* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Old Fort Rae, *Russell* (Can.); east shore of Trout L., *C. O. Hage* (G); gravelly woods near shore of Brintnell L., *9366;* shrubby thicket above timber line on north slope of Colonel Mt., alt. 4300′, *9634;* Nahanni Mts., *Preble & Cary 67* (US).

Abundant throughout the forests of the central and southern parts of the Mackenzie basin, and probably far northward. It is common to abundant in the region of Simpson and at Brintnell L., where it is occasional even above timber line. We found it at an altitude of between 5000′ and 5500′ on the eastern slope of Red Mt. Noted in Fl. Bor.-Am. as occurring northward to the arctic circle; but I have seen specimens from the lower Peel R. (*Miss E. Taylor,* G), while Porsild has collected it in the Mackenzie delta and on the neighboring parts of the arctic coast.

**Lonicera glaucescens** Rydb. in Bull. Torr. Bot. Cl. **24:** 90 (1897); Preble in N. Am. Fauna **27:** 534 (1908); Raup in Jour. Arn. Arb. **17:** 298 (1936).

Fort Smith, *Miss E. Taylor 9658* (Can.); same place, *Seton & Preble 78334* (Can.); same place, *Raup 1318;* Mackenzie R., *Onion* (N); open lowland woods along road near Simpson, shrub 3′ high, *9117.*

Rare at Simpson; collected with flower buds on June 12. This species is common in the open woods of the Wood Buffalo Park, but it is not definitely known north of Simpson.

Hooker, in Fl. Bor.-Am., notes two species of *Lonicera* in the Mackenzie basin, neither of which, it seems, could have been confused with *L. glaucescens,* the only one now known to be common there. *Lonicera caerulea* he ranges "Throughout the woody country, as far North at lat. 66°." Neither this species nor any close relative of it is now known in the Mackenzie basin. The other species noted by Hooker is *L. involucrata,* for which he gives the somewhat equivocal range, "Woody country between lat. 54° and 64°, (but probably confined to the vicinity of the Saskatchewan)." This species actually occurs in the Mackenzie basin, but so far as known at present only in the southern and southwestern districts (Lac la Biche, Lesser Slave L., upper Peace River). It was found by Preble (l. c.) along the lower Athabaska as far north as Pelican Rapid. The significance of these two records for honeysuckles in the upper Mackenzie valley, therefore, remains uncertain.

Hooker's record for *Adoxa Moschatellina* L. presents a similar enigma. It also is said to range in the woody country between lat. 54° and 64°. It has been collected along the lower Athabaska R. at Cascade Rapids above McMurray (*Miss E. Taylor,* G, N, Can.), and in the Lesser Slave Lake district (*Brinkman*), but is unknown farther northward except for the above record.

## VALERIANACEAE

**Valeriana septentrionalis** Rydb. in Mem. N. Y. Bot. Gard. **1:** 375 (1900); Raup in Jour. Arn. Arb. **17:** 299 (1936); Porsild in Sargentia **4:** 67 (1943).

Mossy thickets near mouth of small stream at west end of Brintnell L., *9333.*

Occasional in the above habitat; in flower late in June. Occasional also in the Wood Buffalo Park, and collected by Porsild at Great Bear L.

**Valeriana sitchensis** Bong. Veg. Sitch. 145, repr. 27 (1832); Porsild in Nat. Mus. Can. Bull. **101:** 26 (1945).

Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11265* (Can.).

## CAMPANULACEAE

**Campanula rotundifolia** L. Sp. Pl. 163 (1753); Hooker, Fl. Bor.-Am. **2:** 27 (1834), in part; Macoun, Cat. Can. Pl. Pt. 2: 288 (1884); Raup in Jour. Arn. Arb. **17:** 299 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 32 (1945).

*Campanula linifolia* sensu Hooker, Fl. Bor.-Am. **2:** 27 (1834), in part, non A. DC.

Little Buffalo R., *Russell 89* (G); Resolution, *E. A. & A. E. Preble 163* (US); southwest and north shores of Great Slave L., *Howe 91953* (Can.); Windy Pt., Great Slave L., *Hume 102683* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Rae, *Russell* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 108, 109* (Can.); Nahanni Mts., *Preble & Cary 55* (US); north peak of Nahanni Mt., *Wynne-Edwards 8513* (Can.).

Common in the Wood Buffalo Park, but apparently becoming rare north of Great Slave L. Noted in Fl. Bor.-Am., "Woody country between lat. 54° and 64°."

**Campanula lasiocarpa** Cham. in Linnaea **4:** 39 (1829).

Mackenzie R. between Blackwater R. and Norman, *Crickmay 172* (Can.); gravelly thickets at Camp Pt. and about the western end of Brintnell L., *9456, 9491;* turfy shale slopes on north slope of Colonel Mt., alt. 4000′–5000′, *9643;* rocky stream banks and shale rock-slides in upper valley of Frost Cr., and on west slope of Terrace Mt., alt. 4300′–5500′, *9547.*

Occasional to common on alpine slopes at Brintnell L., but rare at lake-level; collected in flower during middle and late July.

**Campanula aurita** Greene in Pittonia **1:** 221 (1888); Porsild in Nat. Mus. Can. Bull. **101:** 26, 32 (1945).

Liard R. between Nahanni Butte and Simpson, *Crickmay 106, 107* (Can.); west ridge of Franklin Mts. at "River-between-two-mountains," alt. 1000′, *Crickmay 6* (Can.); southern extreme of Franklin Mts., alt. 800′, *Crickmay 30* (Can.); Lone Mt., *Wynne-Edwards 8511, 8512* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alpine slope, *Wynne-Edwards 8377* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11879* (Can.).

## LOBELIACEAE

**Lobelia Kalmii** L. Sp. Pl. 930 (1753); Hooker, Fl. Bor.-Am. **2:** 30 (1834); Macoun, Cat. Can. Pl. Pt. 2: 286 (1884); Raup in Jour. Arn. Arb. **17:** 299 (1936).

Sandy muskeg, north arm of Great Slave L., *Hume 102686* (Can.); near large lake between southern extremities of Franklin Mts., *Crickmay 33* (Can.).

Noted in Fl. Bor.-Am. ". . . in saline marshes in lat. 60°." Apparently rare in the Mackenzie basin, and known east of the mountains only from the above records. We have recently collected it in the valley of the Liard R. near the lower crossing of the Alaska Highway.

## COMPOSITAE

**Grindelia perennis** A. Nels. in Bull. Torr. Bot. Cl. **26:** 355 (1899); Raup in Jour. Arn. Arb. **17:** 299 (1936). See Steyermark in Ann. Mo. Bot. Gard. **21:** 485 (1934).

*Grindelia squarrosa* sensu Macoun, Cat. Can. Pl. Pt. 2: 208 (1884), in part, non (Pursh) Dunal.

*Donia squarrosa* sensu Hooker, Fl. Bor.-Am. **2:** 25 (1834), in part, non Pursh.

Little Buffalo R., *Russell* (Can.).

Hooker gives the northern range of this species as extending between lat. 54° and 64°. It is rather common on the Salt Plains of the Wood Buffalo Park, and Russell's specimen came from such a situation just north of the 60th parallel. It is probable that it extends over at least a part of the region southwest of Great Slave L., if not into the upper Mackenzie valley.

**Solidago multiradiata** Ait. Hort. Kew. **3**: 218 (1789); Hooker, Fl. Bor.-Am. **2**: 5 (1834), in part; Macoun, Cat. Can. Pl. Pt. 2: 212 (1884); Raup in Jour. Arn. Arb. **17**: 300 (1936); Porsild in Nat. Mus. Can. Bull. **101**: 26 (1945).

Northwest shore of Great Slave L., *Bedford* (Can.); lowland woods and gravelly thickets at west end of Brintnell L., *9430;* gravelly beach on south shore of Brintnell L., *9356;* alpine meadows and rock-slides, north slope of Colonel Mt., *9380;* rocky slopes of Red Mt., in scrub timber and at 5500′, *9220, 9728;* Bolstead Cr., Canol Rd., alpine slopes, alt. 5000′–6000′, *Wynne-Edwards 8378* (Can.); Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11266* (Can.).

Common on alpine slopes, and occasional on the shore of Brintnell L. This is the only goldenrod observed in the Brintnell L. area; in flower early in July. Noted in Fl. Bor.-Am. at "Mackenzie R. and Bear Lake."

**Solidago multiradiata** Ait. var. **scopulorum** Gray in Proc. Am. Acad. **17**: 187 (1882); Raup in Jour. Arn. Arb. **17**: 300 (1936); Porsild in Nat. Mus. Can. Bull. **101**: 32 (1945).

*? Solidago Virgaurea* sensu Hooker, Fl. Bor.-Am. **2**: 5 (1834), in part, non L.

Resolution, *Kennicott* (N); Lone Mt., *Wynne-Edwards 8514* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11883* (Can.).

This is the common form of the species in the central part of the Mackenzie basin. It is probable that Hooker's record for *S. Virgaurea*, "Woody country between lat. 54° and 64°," is applicable to it.

**Solidago decumbens** Greene var. **oreophila** (Rydb.) Fernald in Rhod. **38**: 202 (1936); Raup in Jour. Arn. Arb. **17**: 300 (1936).

*Solidago oreophila* Rydb. in Mem. N. Y. Bot. Gard. **1**: 387 (1900).

*Solidago decumbens* sensu Porsild in Nat. Mus. Can. Bull. **101**: 34 (1945), in part, non Greene.

*Solidago stricta* sensu Hooker, Fl. Bor.-Am. **2**: 4 (1834), in part, non Ait.

Fort Smith, *Raup 1367* (Coll. *Mrs. Conibear*); Little Buffalo R., *Russell 46* (G); Resolution, *Onion, Kennicott & Hardisty* (N); Liard R. between Nahanni Butte and Simpson, *Crickmay 123* (Can.); upland prairie west of Mackenzie R. near Simpson, *9912;* Saline R., above Norman, *Wynne-Edwards 8578* (Can.).

Common in the Wood Buffalo Park and in the Simpson locality above mentioned; achenes mature in late August. On the lower Mackenzie this variety probably merges insensibly with the typical form.

**Solidago lepida** DC. var. **elongata** (Nutt.) Fernald in Rhod. **17**: 9 (1915); Raup in Jour. Arn. Arb. **17**: 300 (1936); Porsild in Nat. Mus. Can. Bull. **101**: 34 (1945).

*Solidago elongata* Nutt. in Trans. Am. Phil. Soc. **7**: 327 (1840); Macoun, Cat. Can. Pl. Pt. 2: 216 (1884), in part.

*Solidago canadensis* sensu Hooker, Fl. Bor.-Am. **2**: 1 (1834), in part; Macoun, Cat. Can. Pl. Pt. 2: 216 (1884), in part; Raup in Nat. Mus. Can. Bull. **74**: 165 (1935), in part; non L.

*Solidago procera* sensu Hooker, l. c. 2, in part, non Ait.

Great Slave L., *Richardson* (G); willow thickets on sand bars along Mackenzie R. near Simpson, *9861;* rocky-sandy bank of Mackenzie R. opposite Simpson, *9965;* Mackenzie R. between Wrigley and Blackwater R., *Crickmay 145* (Can.); near Wrigley, *Miss E. Taylor 136* (Can.); Saline R. above Norman, *Wynne-Edwards 8579* (Can.).

Common throughout the central Mackenzie basin and the upper Mackenzie valley. The range of *S. canadensis* is given, ". . . from Lake Huron to Fort Franklin, on the Mackenzie River"; and of *S. procera,* "Woody country between lat. 54° and 64°."

**Solidago lepida** DC. var. **fallax** Fernald in Rhod. **17:** 9 (1915); Raup in Jour. Arn. Arb. **17:** 301 (1936).

Lower Slave R., *Raup 1357;* Resolution, *Kennicott* (N).

**Solidago graminifolia** (L.) Salisb. var. **major** (Michx.) Fernald in Rhod. **46:** 330 (1944).

*Chrysocoma graminifolia* L. Sp. Pl. 841 (1753), in part.

*Solidago lanceolata* L. var. *major* Michx. Fl. Bor.-Am. **2:** 116 (1803); Hooker, Fl. Bor.-Am. **2:** 6 (1834).

*Solidago graminifolia* (L.) Salisb. var. *camporum* (Greene) Fernald, sensu Raup in Jour. Arn. Arb. **17:** 301 (1936).

Rocky-sandy bank of Mackenzie R. opposite Simpson, *9952.*

Occasional in the Wood Buffalo Park region, but apparently rare along the Mackenzie. Hooker gave its northern range, however, "Throughout Canada to lat. 64°."

**Aster alpinus** L. ssp. **Vierhapperi** Onno in Bibl. Bot. **26:** 25, *t. 6, f. 4* (1932); Porsild in Sargentia **4:** 67 (1943), in Nat. Mus. Can. Bull. **101:** 32 (1945).

Liard R. between Nahanni Butte and Simpson, *Crickmay 120* (Can.); north peak of Nahanni Mt., *Wynne-Edwards 8516* (Can.); dry summit of Lone Mt., *Wynne-Edwards 8517* (Can.).

Porsild has collected this species at Great Bear L. and on Mt. Charles and Bear Rock along Bear R.

**Aster sibiricus** L. Sp. Pl. 872 (1753); Porsild in Nat. Mus. Can. Bull. **101:** 26, 32, 33 (1945).

*Aster Richardsonii* Spreng.; Hooker, Fl. Bor.-Am. **2:** 7 (1834); Raup in Jour. Arn. Arb. **17:** 301 (1936).

*Aster montanus* Richardson; Macoun, Cat. Can. Pl. Pt. 2: 219 (1884).

Great Slave L., *R. Bell 23159* (Can.); southwest and north shores of Great Slave L., *Howe 91990* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Rae, *Russell* (Can.); Liard R. between Nahanni Butte and Simpson, *Crickmay 115* (Can.); willow thickets on sandbar in Mackenzie R. near Simpson, *9865;* Simpson, near sandy beach west of island, *Nowosad* (Can.); outwash gravel plain near mouth of N. Nahanni R., *Wynne-Edwards 8540* (Can.); Mackenzie R. between Wrigley and Blackwater R., *Crickmay 142* (Can.); between Blackwater R. and Norman, *Crickmay 174* (Can.); Norman, *Coll.?* (N); Bear R. at Norman, *Miss E. Taylor 14* (G); mossy banks of south shore of Brintnell L., *9597;* damp gravelly thickets at west end of Brintnell L., *9434;* dry rocky gully on south slope of granite mountain west of Brintnell L., *9485;* shale rock-slides on north slope of Colonel Mt., alt. 5000′–6000′, *9640;* shale cliffs on south slope of Red Mt., alt. 5500′, *9741;* north peak of Nahanni Mt., *Wynne-Edwards 8515* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8379* (Can.); Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11278* (Can.).

Occasional to common throughout the Mackenzie valley and high in the Mackenzie Mts.; collected in flower during July and early August.

Mackenzie basin and northern Rocky Mt. material of this complex, commonly reported as *A. Richardsonii* Spreng., is apparently not distinct from *A. sibiricus* of the Bering Sea region (See Porsild in Rhod. **41:** 291; Scamman in Rhod. **42:** 339; Hultén, Fl. Kamtch. **4:** 157–158, and Fl. Aleut. I. 317–318). Our specimens are variable in the serration of the leaves and in the size of the heads and shape of the involucral bracts, but the variations do not seem worthy of taxonomic distinction, as noted by Hultén (Fl. Kamtch.). Most of our Brintnell L material is low in stature, and has one to few rather small flowers to the stem, though no. *9485* is taller (3–4 dm.) and has single large heads.

In 1934 I proposed that the more southern Rocky Mt. relatives of this species, commonly called *A. meritus* A. Nels., be considered a variety of the northern

*A. Richardsonii* (See Contr. Arn. Arb. **6**: 202–204). The southern plants are taller, less pubescent, and have much-branched stems with many short-pediceled heads. In view of the above realignment of *A. Richardsonii,* the following new combination is necessary: **Aster sibiricus** L. var. **meritus** (A. Nels.) comb. nov. (*Aster meritus* A. Nels. in Bot. Gaz. **37**: 268–269, 1904).

**Aster foliaceus** Lindl. in DC. Prodr. **5**: 228 (1836).

Trout Lake, *C. O. Hage* (G).

This material matches plants collected in the Peace River Pass and in the Lesser Slave L. district (see Raup, 1934).

**Aster Lindleyanus** T. & G. Fl. N. Am. **2**: 122 (1841); Macoun, Cat. Can. Pl. Pt. 2: 222 (1884), at least in part; Raup in Jour. Arn. Arb. **17**: 301 (1936); Porsild in Sargentia **4**: 68 (1943).

*Aster paniculatus* sensu Hooker, Fl. Bor.-Am. **2**: 8 (1834), in part, non Nees.

*Aster praecox* sensu Hooker, Fl. Bor.-Am. **2**: 9 (1834), in part, non Nees.

Fort Smith, *Raup 1353* (*Mrs. Conibear* coll.); Resolution, *Kennicott* (N); Great Slave L., *Howe 91065* (Can.); thickets along wood road near Simpson, *9882;* upland woods and prairies west of Mackenzie R. near Simpson, *9922, 9923.*

Occasional to common in the upper Mackenzie country, and collected by Porsild at Mt. Charles along the Bear R. Among the ranges given by Hooker for his segregates in this complex, the farthest north is "Fort Franklin, on the Mackenzie River." Collected with flowers and maturing achenes at Simpson late in August.

**Aster Lindleyanus** T. & G. var. **ciliolatus** (Lindl.) Gray, Syn. Fl. **1**: Pt. 2, 182 (1884); Raup in Jour. Arn. Arb. **17**: 302 (1936).

*Aster ciliolatus* Lindl. in Hooker, Fl. Bor.-Am. **2**: 9 (1834).

Great Slave L., *Richardson* (G).

This specimen is probably part of the type collection of *A. ciliolatus.*

**Aster Lindleyanus** T. & G. var. **comatus** Fernald in Eggleston (Fl. Vt.) in Rhod. **6**: 142 (1904); Raup in Jour. Arn. Arb. **17**: 302 (1936).

Mackenzie R., *Kennicott* (N).

This variety is occasional in the Wood Buffalo Park. Its presence on the Mackenzie, at an unknown locality, is based upon the single specimen of Kennicott.

**Aster ericoides** L. Sp. Pl. 875 (1753); Raup in Jour. Arn. Arb. **17**: 302 (1936). See Mackenzie in Rhod. **28**: 65 (1926), and Blake in Rhod. **32**: 136–140 (1930).

Little Buffalo R. near Lobstick Cr., *Russell 2* (G).

Common in dry prairies of the Wood Buffalo Park, and probably extending into similar habitats in the upper Mackenzie valley.

**Aster falcatus** Lindl. in Hooker, Fl. Bor.-Am. **2**: 12 (1834); DC. Prodr. **5**: 241 (1836); Macoun, Cat. Can. Pl. Pt. 2: 223 (1884); Raup in Jour. Arn. Arb. **17**: 303 (1936).

*Aster ramulosus* Lindl. in Hooker, Fl. Bor.-Am. **2**: 13 (1834).

Mackenzie R., *Onion & Ross* (N); willow thickets on sand bars in Mackenzie R. near Simpson, *9866;* rocky-sandy bank of Mackenzie R. opposite Simpson, *9964;* Simpson, near sandy beach west of island, *Nowosad* (Can.); Wrigley, *Kindle* (Can.); Saline R., above Norman, *Wynne-Edwards 8580* (Can.).

Common in the Simpson habitats; achenes maturing in late August. With its long, linear, glabrescent stem-leaves and but little imbricated involucral bracts, this material resembles a part of the type of *A. falcatus* at the Gray Herbarium.

The latter is a rather strict plant, with relatively few heads, while ours are much branched and have many heads. The Simpson specimens are a good match for those which I have collected at McMurray (*7069*) and Chipewyan (*4684*). *Aster falcatus* is noted in Fl. Bor.-Am. simply as occurring in "Arctic America"; but *A. ramulosus,* which appears to be identical with it, is said to extend from "Saskatchewan to Fort Franklin on the Mackenzie River. . . ."

**Aster junceus** Ait. Hort. Kew. **3:** 204 (1789); Macoun, Cat. Can. Pl. Pt. 2: 225 (1884); Raup in Jour. Arn. Arb. **17:** 302 (1936).

*Aster laxifolius* sensu Lindl. in Hooker, Fl. Bor.-Am. **2:** 10 (1834), in large part, non Nees.

*Aster Franklinianus* Rydb. in Bull. Torr. Bot. Cl. **37:** 141 (1910).

Little Buffalo R., *Russell 42, 78* (G); Great Slave L., *Richardson* (G, N); Resolution, *Onion, Kennicott & Hardisty* (N); Rae, *Russell* (Can.); Mackenzie R., *Kennicott* (N); fence-row thicket at Simpson, *9846;* willow thickets on sand bars in Mackenzie R. near Simpson, *9862, 9863;* rocky-sandy bank of Mackenzie R. opposite Simpson, *9953;* Simpson, near sandy beach west of island, *Nowosad* (Can.); Mackenzie R. between Wrigley and Blackwater R., *Crickmay 146* (Can.).

This is one of the most abundant asters in the central Mackenzie basin. It is common at Simpson, and apparently throughout the upper Mackenzie valley. Collected with flowers and maturing achenes late in August. The concept of *Aster junceus* here used is a broad one. Much of our Mackenzie basin material seems to represent the species in its strict sense, but there is wide variation which may, with more specimens and more study, justify subdivision.

**Aster spathulatus** Lindl. in Hooker, Fl. Bor.-Am. **2:** 8 (1834).

*Aster ? ptarmicoides* sensu Porsild in Nat. Mus. Can. Bull. **101:** 34 (1945), non T. & G.

Mackenzie R. between Wrigley and Blackwater R., *Crickmay 143* (Can.); Saline R., above Norman, *Wynne-Edwards 8581* (Can.).

The above specimens are a good match for Richardson specimens from Great Bear L. in Herbs. G and N. These plants are evidently part of the type material, which was stated in Fl. Bor.-Am. to have come from "Bear Lake and Fort Franklin, on the Mackenzie River. *Dr. Richardson.*"

**Aster angustus** (Lindl.) T. & G. Fl. N. Am. **2:** 162 (1841).

*Tripolium angustum* Lindl. in Hooker, Fl. Bor.-Am. **2:** 15 (1834).

Stony bank of Mackenzie R. a few miles below Providence, *9975.*

Occasional or rare; found with maturing achenes Sept. 9. The type of *Aster angustus* "β. ramis polycephalis" apparently came from Great Slave Lake, collected by Richardson. Our plants from the upper Mackenzie answer the description very closely. So far as I am aware, the species had not been collected in the Mackenzie basin since Richardson's time except in the upper Peace River region (Raup in Jour. Arn. Arb. **23:** 25, 1942).

**Erigeron angulosus** Gaudin var. **kamtschaticus** (DC.) Hara in Rhod. **41:** 389 (1939). See also Fernald in Rhod. **40:** 346 (1938).

*Erigeron kamtschaticus* DC. Prodr. **5:** 290 (1836).

*Erigeron glabratus* sensu Hooker, Fl. Bor.-Am. **2:** 18 (1834), non Hoppe.

*Erigeron acris* L. var. *droebachensis* Blytt sensu Macoun, Cat. Can. Pl. Pt. 2: 235 (1884).

*Erigeron acris* L. var. *asteroides* (Andrz.) DC.; Raup in Jour. Arn. Arb. **17:** 303 (1936); Porsild in Sargentia **4:** 68 (1943), in Nat. Mus. Can. Bull. **101:** 34 (1945).

Northwest shore of Great Slave L., *Bedford* (Can.); Saline R., above Norman, *Wynne-Edwards 8582* (Can.); gravelly banks and thickets along shore of Brintnell L. at Camp Pt., *9573;* in old cabin clearing near east end of Brintnell L., *9596.*

Occasional to common in the habitats mentioned. It is common in the central Mackenzie basin, and Porsild has collected it at Great Bear L. Noted in Fl. Bor.-Am. ". . . from the Saskatchewan to Fort Franklin on the Mackenzie River."

**Erigeron elatus** Greene in Pittonia **3**: 164 (1897). See Fernald in Rhod. **40**: 347 (1938).

*Erigeron acris* L. var. *arcuans* Fernald; Raup in Jour. Arn. Arb. **17**: 303 (1936).

Fort Smith, *Miss E. Taylor* (N); Little Buffalo R., *Russell 77* (G); Mackenzie R., *Onion* (N); muskeg thickets on the north and west shores of Brintnell L., *9352, 9707;* cleared muskeg at east end of Brintnell L., *9351.*

Common in the Brintnell L. habitats noted; in flower early in July, and achenes mature early in August. This species is common in the Athabaska–Great Slave L. region, and I have seen a specimen from as far north as Good Hope (*Miss E. Taylor,* Can.).

**Erigeron jucundus** Greene in Pittonia **3**: 165 (1897).

*Erigeron acris* L. var. *debilis* Gray; Raup in Jour. Arn. Arb. **17**: 303 (1936). See Rhod. **12**: 225 (1910).

Shale cliffs on south slope of Red Mt., alt. 5500′, *9739, 9755;* shale crevices and slide rock on south slope of Terrace Mt., alt. 5000′, *9687.*

Occasional to common above timber line at Brintnell L.; in flower early in August. Apparently rare in the Mackenzie basin. I have collected it only in the mountains along the upper Peace R., and at the eastern end of Great Slave L. Part of our Brintnell L. material is peculiar in having rather thick stems, but otherwise it seems fairly typical.

**Erigeron unalaschkensis** (DC.) Vierh. in Beih. Bot. Centralbl. **19**: 492 (1906); Porsild in Nat. Mus. Can. Bull. **101**: 26 (1945).

*Erigeron pulchellum* var. *unalaschkense* DC. Prodr. **5**: 287 (1836).

Turfy thickets and mossy banks on north slope of Colonel Mt., alt. 4000′–5000′, *9403, 9639;* rocky places along brook on west slope of Terrace Mt., alt. 5000′, *9523;* Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11826* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8380* (Can.).

Rare to occasional in the Brintnell L. area; found flowering during most of July.

**Erigeron eriocephalus** J. Vahl in Fl. Dan. **13**: *t. 2299* (1840). See Polunin in Nat. Mus. Can. Bull. **92**: 343–345 (1940); Malte in Rhod. **36**: 192 (1934).

Rocky places along small brook on west slope of Terrace Mt., alt. 5000′, *9522;* mountain range west of Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8382* (Can.).

Common on the first-mentioned site; in flower about mid-July. *Erigeron eriocephalus* is here growing with *E. unalaschkensis,* from which it is easily distinguished in the field.

**Erigeron compositus** Pursh var. **trifidus** (Hooker) Gray in Proc. Am. Acad. **16**: 90 (1880); Raup in Jour. Arn. Arb. **17**: 303 (1936); Porsild in Sargentia **4**: 68 (1943). See Contr. Gray Herb. **49**: 72–79 (1917); Univ. Wyo. Publ. Bot. **1**: 176 (1926).

*Erigeron trifidus* Hooker, Fl. Bor.-Am. **2**: 17 (1834).

Liard R. between Nahanni Butte and Simpson, *Crickmay 117* (Can.).

An arctic and alpine species, found in the central Mackenzie basin only on Great Slave L. Porsild has identified variety *trifidus* at Great Bear L. and on Mt. Charles, but assigns most of his western arctic material to the typical form.

**Erigeron glabellus** Nutt. Gen. Am. Pl. 2: 148 (1818); Hooker, Fl. Bor.-Am. **2:** 19 (1834), in part; Macoun, Cat. Can. Pl. Pt. 2: 232 (1884); Raup in Jour. Arn. Arb. **17:** 304 (1936).

*Erigeron pulchellus* sensu Hooker, Fl. Bor.-Am. **2:** 19 (1834), in part, non Michx.

Resolution, *Kennicott* (N); Liard R. between Nahanni Butte and Simpson, *Crickmay 118, 119, 179* (Can.); near Wrigley, *Miss E. Taylor 121* (Can.); same place, *Kindle* (Can.).

This species is rather common on dry prairies in the Wood Buffalo Park, and probably extends into similar habitats in the upper Mackenzie valley. Most of the material cited in Fl. Bor.-Am. which may be referred here is said to range northward in the "woody country" to lat. 64°.

**Erigeron philadelphicus** L. Sp. Pl. 863 (1753); Hooker, Fl. Bor.-Am. **2:** 19 (1834), in part; Macoun, Cat. Can. Pl. Pt. 2: 233 (1884); Raup in Jour. Arn. Arb. **17:** 304 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 33 (1945).

*Erigeron purpureus* Ait. sensu Hooker, Fl. Bor.-Am. **2:** 19 (1834), in part.

Lower Slave R., *Raup 1344;* Mackenzie R., *Kennicott* (N); south bank of Mackenzie R., 10 mi. below Mills L., *Wynne-Edwards 8559* (Can.); sand bar along Mackenzie R. near Simpson, *9858;* old clearing at Simpson, *9131;* Wrigley, *Miss E. Taylor 43* (G).

Occasional; found in flower both early and late in the summer. In Fl. Bor.-Am. this species is said to range northward to lat. 64°, while *E. purpureus* is noted "From Lake Huron . . . to the Arctic Circle."

**Erigeron hyssopifolius** Michx. Fl. Bor.-Am. **2:** 123 (1803); Raup in Jour. Arn. Arb. **17:** 304 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 26, 32 (1945).

Smith Portage, *Miss E. Taylor 11157* (Can.); Little Buffalo R., *Russell 81* (G); Pine Pt., Great Slave L., *Brooke* (Can.); Windy Pt., Great Slave L., *Hume 102687* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Mackenzie R., *Ross* (N); and *Onion & Ross* (N); Liard R. between Nahanni Butte and Simpson, *Crickmay 116* (Can.); north peak of Nahanni Mt., *Wynne-Edwards 8518* (Can.).

This species was noted by Porsild as common along a small tributary of Little Keele R., Canol Rd., mi. 51 E. It is occasional in the Wood Buffalo Park, and I have seen a specimen from Great Bear L. (*J. M. Bell,* Can.).

**Antennaria monocephala** DC. Prodr. **6:** 269 (1837); Porsild in Nat. Mus. Can. Bull. **101:** 27 (1945). See Rhod. **36:** 101–117 (1934).

Mossy bank on stony shore of Brintnell L. at Camp Pt., *9156;* turfy shale on north slope of Colonel Mt., alt. 4300′, *9662;* south and east slopes of Red Mt., alt. 5000′–5500′, *9286, 9722, 9758;* high shale slopes on west side of Terrace Mt., alt. 6000′, *9552;* Bolstead Cr., Canol Rd., mi. 111 E., alpine slopes, alt. 5000′–6000′, *Wynne-Edwards 8386, 8387* (Can.).

Common on alpine slopes at Brintnell L., but rare at lake-level; found flowering in late June, and with mature heads early in August. Porsild notes it as common also in Macmillan Pass.

**Antennaria densifolia** A. E. Porsild in Nat. Mus. Can. Bull. **101:** 26 (1945).

Nahanni Mt., *Wynne-Edwards 8521* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., alt. about 6000′, *Wynne-Edwards 8384* (Can., TYPE COLL.); Sekwi R., Canol Rd., mi. 174 E., on dry turfy limestone scree, alt. 3625′, *Porsild 11881* (Can.).

Porsild reports this new species also from Mt. Charles, along the Bear R.

**Antennaria Ekmaniana** A. E. Porsild in Sargentia **4:** 69 (1943), in Nat. Mus. Can. Bull. **101:** 27 (1945).

Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11823* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., rocky slope, *Wynne-Edwards 8385* (Can.).

**Antennaria isolepis** Greene in Ottawa Nat. **25:** 41 (1911); Porsild in Sargentia **4:** 71 (1943), in Nat. Mus. Can. Bull. **101:** 27, 32 (1945). See Malte in Rhod. **36:** 108 (1934).

Damp margin of lagoon in gravel plain at west end of Brintnell L., *9454;* on gravelly cut bank of Frost Cr., in upper valley, alt. 4500′, *9512;* dry dolomitic summit of Lone Mt., *Wynne-Edwards 8519* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8384-A* (Can.).

Common locally at Brintnell L.; in flower in late June and mid-July.

**Antennaria media** Greene in Pittonia **3:** 286 (1898), **4:** 84 (1899).

Turfy shale slopes on hogback, north slope of Colonel Mt., alt. 4300′, *9648.*

Occasional; in flower late in July.

**Antennaria rosea** (D. C. Eat.) Greene in Pittonia **3:** 281 (1898); Raup in Jour. Arn. Arb. **17:** 304 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 33 (1945).

Fort Smith, *Raup 1379;* lower Slave R., *Raup 1380;* Great Slave L., *R. Bell 23160* (Can.); southwest and north shores of Great Slave L., *Howe 91995* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); south bank of Mackenzie R., 10 mi. below Mills L., *Wynne-Edwards 8561* (Can.); Providence, *Preble & Cary 39* (US); Liard R. between Nahanni Butte and Simpson, *Crickmay 111* (Can.).

Common in the Athabaska–Great Slave L. region, and at least occasional in the upper Mackenzie country.

**Antennaria** sp.

In scrub timber on south slope of Red Mt., north of Brintnell L., alt. 3000′–4000′, *9214.*

Occasional; collected with young flowers on June 21.

**Antennaria subviscosa** Fernald in Rhod. **16:** 131 (1914). See also Fernald in Rhod. **35:** 334 (1933), and **47:** 232, *t. 916, 917* (1945).

Scrub timber on south slope of Red Mt., north of Brintnell L., *9215.*

This is an eastern species, previously known only from the Gaspé Peninsula.

**Antennaria nitida** Greene in Pittonia **3:** 283 (1898); Raup in Jour. Arn. Arb. **17:** 305 (1936); Porsild in Sargentia **4:** 71 (1943), in Nat. Mus. Can. Bull. **101:** 33 (1945).

South bank of Mackenzie R., 10 mi. below Mills L., *Wynne-Edwards 8560* (Can.); Providence, *Dutilly 67, 69* (G); upland prairie west of Mackenzie R. near Simpson, *9910.*

Common in the Athabaska–Great Slave L. district, and at least occasional in the upper Mackenzie valley. Porsild has collected it at Bear Rock, along the Mackenzie, and at Great Bear L. At Simpson the heads are mature in late August.

**Antennaria campestris** Rydb. in Bull. Torr. Bot. Cl. **24:** 304 (1897); Raup in Jour. Arn. Arb. **17:** 305 (1936).

Southwest and north shores of Great Slave L., *Howe 91996* (Can.).

Occasional in dry prairies of the Wood Buffalo Park, and probably extending into the upper Mackenzie country. In flower about mid-June.

**Antennaria oxyphylla** Greene in Pittonia **4:** 284 (1901); Raup in Jour. Arn. Arb. **17:** 305 (1936).

Fort Smith, *Raup 1375.*

So far as is known this species just reaches the southeastern corner of our region. It is probable, however, that it will be found farther to the northwestward in the upper Mackenzie valley. It is occasional in dry upland woods in the Athabaska Lake region.

**Antennaria pulcherrima** (Hooker) Greene in Pittonia **3:** 176 (1897); Raup in Jour. Arn. Arb. **17:** 304 (1936); Porsild in Sargentia **4:** 72 (1943), in Nat. Mus. Can. Bull. **101:** 32 (1945).

*Antennaria carpathica* var. *pulcherrima* Hooker, Fl. Bor.-Am. **1:** 329 (1834).

Lone Mt., *Wynne-Edwards 8520* (Can.).

Rare or occasional in the central Mackenzie basin, and apparently also in the upper Mackenzie valley. Porsild collected it at several places on Great Bear L., however. In flower about mid-July.

**Helianthus annuus** L. Sp. Pl. 904 (1753).

Weed in a grain field on the west bank of the Mackenzie R. near Simpson, *9932.*

This species is doubtfully included in the spontaneous flora. It was in flower late in August, and whether or not it was able to mature its seed is unknown. It probably came in with seed grain, and is nothing more than a waif.

**Helenium autumnale** L. Sp. Pl. 886 (1753); Hooker, Fl. Bor.-Am. **1:** 317 (1834); Macoun, Cat. Can. Pl. Pt. 2: 249 (1884).

Mackenzie R., *Onion, Kennicott & Hardisty* (N); rocky-sandy bank of Mackenzie R. opposite Simpson, *9956;* in silty soil near Mackenzie R. at Simpson, *Nowosad* (Can.).

Common at the Simpson locality; collected with maturing heads and a few flowers late in August. The northern form of *H. autumnale* has been designated by some students as var. *grandiflorum* (Nutt.) Gray (*H. macranthum* Rydb.) (See Gray, Syn. Fl. 1: Pt. 2, 349). The size of the heads, however, is so variable, both in the same colony and on the same plant, that the separation seems hardly justifiable. This species was noted in Fl. Bor.-Am., "Throughout British North America, from Lake Huron nearly to the Arctic Circle . . . ," and there is a sheet in Herb. G labeled "High northern specimen Coll. in Franklin Exped." There is also one in Herb. Can. marked "British N. Am. *Richardson.*" With the exception of the Onion, Kennicott & Hardisty specimen, our material from Simpson is the first authentication of the earlier records of the species in the entire Mackenzie basin. The Herb. N specimen may well have come from the vicinity of Simpson, as I. S. Onion, one of the principal contributors, was located there for some years.

**Achillea sibirica** Ledeb. Ind. Sem. Hort. Dorpat (1811), Fl. Ross. **2:** 528 (1844); Raup in Jour. Arn. Arb. **17:** 305 (1936); Porsild in Sargentia **4: 73** (1943), in Nat. Mus. Can. Bull. **101:** 35 (1945).

*Achillea multiflora* Hooker, Fl. Bor.-Am. **1:** 318 (1834); Macoun, Cat. Can. Pl. Pt. 2: 251 (1884).

Mackenzie R., *Onion* (N); rocky-sandy bank of Mackenzie R. opposite Simpson, *9948;* five mi. above Old Fort Norman, *Wynne-Edwards 8566* (Can.).

Occasional to common along the main rivers; found with maturing heads late in August. Noted in Fl. Bor.-Am., "Throughout the woody country, and as far north as Fort Franklin." Porsild has collected it in the Mackenzie River delta.

**Achillea Millefolium** L. Sp. Pl. 899 (1753); Hooker, Fl. Bor.-Am. **1:** 318 (1834), in part; Macoun, Cat. Can. Pl. Pt. 2: 251 (1884), in part; Raup in Jour. Arn. Arb. **17:** 306 (1936).

Fort Smith, *Raup 1398, 1399* (Coll. *Mrs. Conibear*); Little Buffalo R. near 60th parallel, *Russell 85* (G); junction of Little Buffalo and Nyarling Rivers, *Russell 8* (G); Mackenzie R., *Onion* (N); rocky-sandy bank of Mackenzie R. opposite Simpson, *9949;* Bear R., *Miss E. Taylor 88* (Can.).

Common throughout the central Mackenzie basin and at least the upper Mackenzie valley; collected with flowers and maturing heads late in August.

**Achillea borealis** Bong. in Mém. Acad. Imp. Sci. St. Pétersb. IV. Math. **2:** 149 (1833); Raup in Jour. Arn. Arb. **17:** 306 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 27, 34, 35 (1945).

*Achillea Millefolium* sensu Hooker, Fl. Bor.-Am. **1:** 318 (1834), in part; Macoun, Cat. Can. Pl. Pt. 2: 251 (1884), in part; non L.

Liard R. between Nahanni Butte and Simpson, *Crickmay 110* (Can.); Saline R., above Norman, *Wynne-Edwards 8583* (Can.); Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11279* (Can.).

**Matricaria ambigua** (Ledeb.) Kryl. Fl. Alt. **3:** 625 (1904); Porsild in Sargentia **4:** 73 (1943). See M. P. Porsild in Medd. om Grønl. **92, 1:** 72 (1932).

*Pyrethrum inodorum* sensu Hooker, Fl. Bor.-Am. **1:** 320 (1834), non Sm.

*Matricaria inodora* sensu Macoun, Cat. Can. Pl. Pt. 2: 253 (1884), non L.

*Pyrethrum ambiguum* Ledeb. Fl. Alt. **4:** 118 (1833).

I include this species with much uncertainty. Porsild (l. c.) states that it is "A common species along the Arctic Coast and thus far not collected in the interior of our district." Nevertheless it is noted in Fl. Bor.-Am. as occurring ". . . as far north as Bear Lake," indicating that it was collected somewhere along the route of the Franklin expeditions as they traveled northward. There are Richardson specimens in Herbs. G and N, but all of them are without specific locality data.

**Chrysanthemum integrifolium** Richardson, Bot. App. Frankl. Jour. 749 (1823); Porsild in Nat. Mus. Can. Bull. **101:** 27 (1945).

Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8398, 8399* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11866* (Can.).

**Tanacetum huronense** Nutt. var. **bifarium** Fernald in Rhod. **37:** 334, *t. 377, f. 3, 4* (1935); Raup in Jour. Arn. Arb. **17:** 307 (1936).

*Tanacetum pauciflorum* Richardson, sensu Hooker, Fl. Bor.-Am. **1:** 327 (1834), in part.

This plant is somewhat doubtfully included here. It is common on the sandy beaches around L. Athabaska, but I have seen no material from north of that region. In Fl. Bor.-Am., however, it is noted as occurring in the "Woody country, between lat. 54° and 64°, North." Whether this record is based entirely upon specimens that may have been collected at L. Athabaska is unknown, but the species is to be expected farther north.

**Artemisia canadensis** Michx. Fl. Bor.-Am. **2:** 129 (1803); Macoun, Cat. Can. Pl. Pt. 2: 256 (1884); Raup in Jour. Arn. Arb. **17:** 308 (1936); Porsild in Nat. Mus. Can. Bull. **101:** 34 (1945).

*Artemisia desertorum* Bess. in Hooker, Fl. Bor.-Am. **1:** 325 (1834), in part.

Fort Smith, *Raup 1388* (Coll. *Mrs. Conibear*); Resolution, *Onion, Kennicott & Hardisty* (N); Saline R. above Norman, *Wynne-Edwards 8584* (Can.).

Occasional to common in the central Mackenzie basin, though apparently less common northward. I have seen a specimen from the Mackenzie R. about 30 mi. north of the Arctic Circle (*Miss E. Taylor,* Can.).

**Artemisia biennis** Willd. Phytogr. 11 (1794); Hooker, Fl. Bor.-Am. **1:** 325 (1834); Macoun, Cat. Can. Pl. Pt. 2: 259 (1884); Raup in Jour. Arn. Arb. **17:** 308 (1936); Porsild in Sargentia **4:** 73 (1943).

Mackenzie R., *Onion & Ross* (N); open field at Simpson, *9857;* sand bars along Mackenzie R. near Simpson, *9875.*

Common in the Simpson area; in flower late in August. Porsild has collected it as far north along the Mackenzie as the Ramparts above Good Hope.

**Artemisia frigida** Willd. Sp. Pl. **3:** 1838 (1804); Macoun, Cat. Can. Pl. Pt. 2: 259 (1884); Raup in Jour. Arn. Arb. **17:** 308 (1936); Porsild in Sargentia **4:** 73 (1943).

East bank of Mackenzie R. about 7 mi. above Wrigley, *Crickmay 28* (Can.).

This species has been collected only once in the upper Mackenzie valley, though it is common at L. Athabaska and in the Wood Buffalo Park, and I have

seen specimens from the lower Mackenzie (*McConnell,* Can.; *Miss E. Taylor,* Can.). Porsild has collected it in the Mackenzie delta and on the arctic coast. The only earlier record we have is in Macoun's Catalogue: "Mackenzie River. (*McGill Coll. Herb.*)."

**Artemisia arctica** Less. in Linnaea **6**: 213 (1831); Porsild in Sargentia **4**: 73 (1943), in Nat. Mus. Can. Bull. **101**: 27 (1945). See Hultén in Fl. Kamtch. **4**: 176–180 (1930).

Turfy shale slopes on north side of Colonel Mt., alt. 4000′–6000′, *9641;* damp grassy place in willow-birch scrub, upper valley of Frost Cr., alt. 4000′, *9555;* summit and upper slopes of Red Mt., *9216, 9738;* Bolstead Cr., Canol Rd., mi. 111 E., alpine slopes, alt. 5000′, *Wynne-Edwards 8388, 8389* (Can.).

Common to abundant in alpine areas at Brintnell L., and noted by Porsild as a "dominant species" in Macmillan Pass. In flower during most of July and early August. Porsild reports it common also in the Richardson Mts., and along the arctic coast west of the Mackenzie.

**Artemisia Tilesii** Ledeb. in Mém. Acad. Imp. Sci. St. Pétersb. **5**: 568 (1812); Raup in Jour. Arn. Arb. **17**: 308 (1936); Porsild in Nat. Mus. Can. Bull. **101**: 27 (1945).

*Artemisia vulgaris* sensu Hooker, Fl. Bor.-Am. **1**: 322 (1834), in part; Macoun, Cat. Can. Pl. Pt. 2: 257 (1884), in part; non L.

Stony-gravelly shore of Great Slave L. at Wrigley Harbor, *9981;* east shore of Trout L., *C. O. Hage* (G); Mackenzie R., *Kennicott* (N); willow thickets on sand bars along Mackenzie R. near Simpson, *9860;* Bear R., *Miss E. Taylor* (Can.); thickets on gravel beaches at Brintnell L., *9305, 9691;* dry gully on lower slope of granite mountain west of Brintnell L., *9472;* gravelly thicket in gorge on north slope of Colonel Mt., alt. 3000′, *9832;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11277* (Can.).

Common in the habitats cited above, and occasional on river banks and lake shores in the Peace and Athabaska R. regions. I have seen specimens also from Great Bear L. (*Richardson,* Can.; *J. M. Bell,* Can.), and from Good Hope (*Onion,* N). In flower about mid-July (see below).

The specimens collected by us in 1939 fall rather clearly into three groups which are left provisionally in *A. Tilesii* sens. lat. Numbers *9981* and *9860* are tall slender plants with moderate-sized, upright, more or less ovoid heads (involucres about 4 mm. high, somewhat arachnoid) arranged in elongated paniculate inflorescences which overtop the leaves. The leaves are long-lanceolate, glabrescent and bright green above, entire or with a few divergent acute lobes. These plants are from Ft. Simpson and the western end of Great Slave Lake, and they strongly resemble specimens from the Peace and Athabaska Rivers (Raup *6001, 7074;* Raup & Abbe *4359, 4393*), as well as specimens from Hudson Bay (*Robt. Bell 100; J. M. Macoun 79263*). From the size of the heads they might suggest *A. Douglasiana* Bess. (*A. vulgaris* subsp. *heterophylla;* see Clausen, Keck & Heisey in Carn. Inst. Wash. Publ. no. 520: 327, and Hall & Clements, ibid., Publ. no. 326: 76), but the leaves and habit seem to relate them to the *A. Tilesii* group, perhaps to forms like the type of *A. Gormani* Rydberg, which came from the L. Iliamna region of Alaska (*Gorman 281*).

A second group includes nos. *9472, 9832* and *9691,* all from the vicinity of Brintnell L. These are also tall plants whose leaves are glabrescent and green above. The leaves are more deeply lobed than in group 1, however, though in no. *9832* most of the upper ones are entire. The inflorescences are more loosely paniculate, the fewer and much larger heads with involucral bracts up to 6 mm. long, slightly arachnoid or nearly glabrous. The dry, pressed heads are up to 1 cm. across, and are nodding, on pedicels as much as 2 cm. long. These speci-

mens are a good match for material collected in Alaska (*Scamman 848, 893, 1035; Porsild 1484, 1633*), but no such large-headed forms have been seen in the Mackenzie country. They appear to be nearest to *A. Tilesii* s. l. as understood by Hall & Clements (Carn. Inst. Wash. Publ. no. 326: 71–72), and to the var. *elatior* T. & G. (*A. Tilesii* subsp. *unalaschcensis* (Bess.) Hultén in Fl. Aleut. I. 327; see also Clausen, Keck & Heisey in Carn. Inst. Wash. Publ. no. 520: 325–344).

The third group contains only one number, *9305*, but it shows the greatest divergence from the concept of *A. Tilesii* as outlined above. The plants are much lower in stature (up to 4 dm.), with simple, racemose inflorescences of a few nodding heads. The involucral bracts are 4–5 mm. long, arachnoid, and the heads are 6–7 mm. in diameter. The leaves, except the uppermost, are deeply divided into linear-lanceolate lobes, and are arachnoid pubescent on both sides, though darker green above. The closest relationship seems to be with the second group mentioned above (*A. Tilesii* var. *elatior*), but the simpler inflorescences and more deeply lobed leaves, pubescent above, suggest a distinctive form.

**Petasites frigidus** (L.) Fries Summa Veg. Scand. 182 (1845); Macoun, Cat. Can. Pl. Pt. 2: 260 (1884); Porsild in Sargentia **4**: 74 (1943), in Nat. Mus. Can. Bull. **101**: 27 (1945).

*Tussilago frigida* L. Sp. Pl. 865 (1753).

*Nardosmia frigida* (L.) Hooker, Fl. Bor.-Am. **1**: 307 (1834).

*Nardosmia sagittata* sensu Hooker, Fl. Bor.-Am. **1**: 307 (1834), in part, non Pursh.

*Nardosmia corymbosa* (R. Br.) Hooker, Fl. Bor.-Am. **1**: 307 (1834), in part.

Wet grassy place in willow scrub, upper valley of Frost Cr., north of Brintnell L., alt. 4000′, *9519;* Bolstead Cr., Canol Rd., mi. 111 E., alpine slopes, alt. 4500′–5000′, *Wynne-Edwards 8397* (Can.); Macmillan Pass, Canol. Rd., mi. 225 E., *Porsild 11270* (Can.).

At Brintnell L. this plant was found only in the single locality cited, though it was common there. I have seen no material from the upper Mackenzie valley, though it appears to be common along the lower Mackenzie, in the Richardson Mts., and on the Arctic coast (Porsild, 1943). *Petasites frigidus* in our region is readily distinguished from *P. vitifolius, P. sagittatus,* and *P. palmatus,* in the absence of leaves, by its deeply alveolate receptacle. The spaces between the alveolae consist of sharpened and often toothed ridges, whereas in the other three species the pits are sunken in a more or less flat surface. Eurasian specimens of *P. frigida* show the same character, but the ridges tend to be lower, blunter, and less toothed.

**Petasites palmatus** (Ait.) Gray, Bot. Calif. **1**: 407 (1876); Macoun, Cat. Can. Pl. Pt. 2: 260 (1884); Raup in Jour. Arn. Arb. **17**: 309 (1936); Porsild in Nat. Mus. Can. Bull. **101**: 32 (1945).

*Tussilago palmata* Ait. Hort. Kew. **3**: 188 (1789).

*Nardosmia palmata* (Ait.) Hooker, Fl. Bor.-Am. **1**: 308 (1834).

Fort Smith, *Raup 1435;* summit of Lone Mt., *Wynne-Edwards 8522* (Can.).

Noted in Fl. Bor.-Am., "From Lake Huron . . . to the Bear Lake, lat. 67°, north," and I have seen a specimen from the latter place (*J. M. Bell,* Can.). The species is common in the central Mackenzie basin, but apparently rare or occasional along the upper Mackenzie R.

**Petasites vitifolius** Greene in Leaflets **1**: 180 (1906); Raup in Jour. Arn. Arb. **17**: 309 (1936).

Resolution, *Kennicott ?* (N); Mackenzie R., *Onion* (N); Simpson, May 25, 1860, *Coll.?* (N).

This species is occasional to common in the Athabaska–Great Slave L. region, but apparently less common northward. I have seen no authentic material from north of Simpson.

**Petasites sagittatus** (Banks) Gray, Bot. Calif. **1:** 407 (1876); Macoun, Cat. Can. Pl. Pt. 2: 260 (1884); Raup in Jour. Arn. Arb. **17:** 309 (1936); Porsild in Sargentia **4:** 75 (1943), in Nat. Mus. Can. Bull. **101:** 27 (1945).

*Tussilago sagittata* Banks ex Pursh, Fl. Am. Sept. **2:** 531 (1814).

*Nardosmia sagittata* (Banks) Hooker, Fl. Bor.-Am. **1:** 307 (1834).

Clewi R., *Russell 15* (G); old clearing in lowland woods near Simpson, *9102.*

This species is abundant in the Wood Buffalo Park and at least occasional northward to Great Bear L. and the Mackenzie delta. The Simpson specimens were found with maturing achenes on June 12. Porsild noted it as rare in Macmillan Pass.

All the species of *Petasites* were much confused (as *Nardosmia*) in Fl. Bor.-Am. This is obvious from the original labels on Hooker duplicates in American herbaria, and from photographs of specimens in the British Museum. Porsild has greatly clarified the tangle in Sargentia **4:** 74, 75.

**Arnica alpina** (L.) Olin ssp. **genuina** Maguire in Brittonia **4:** 408 (1943).

Gravel plain near shore of Brintnell L., *9200;* rich mossy spruce woods on fan at base of Colonel Mt., *9492;* alpine meadows and scrub, north slope of Colonel Mt., *9384;* birch scrub on south slope of Terrace Mt., alt. 4500′, *9686.*

Common on the high north slopes of Colonel Mt., but rare or occasional elsewhere in the district; in flower in late June and early July. Maguire does not admit genuine *A. alpina* to the American flora, but our Brintnell L. plants so nearly match many northern European specimens of *A. alpina* in the Gray Herbarium that I am forced to identify them with it. Most of these plants have narrow, lance-attenuate leaves which suggest ssp. *attenuata,* but they are not so glandular as in the latter. Furthermore, the usual pair of small leaves high up on the stem in ssp. *attenuata* is almost entirely wanting. The ligules of the flowers are much more deeply cut than in any American material that I have seen (in some cases to a depth of 5 mm.), thus again suggesting the European plant. Maguire makes a key character of the glandularity on the involucre and upper part of the stem. In ssp. *genuina* the stipitate glands are lacking or very short and obscured, while in American varieties they are usually well developed. In some of our plants they are almost entirely wanting, while in others they are prominent only on the upper part of the stem. The latter apparently approach ssp. *angustifolia.*

**Arnica alpina** (L.) Olin ssp. **angustifolia** (Vahl.) Maguire in Madroño **6:** 153 (1942); Porsild in Sargentia **4:** 75 (1943), in Nat. Mus. Can. Bull. **101:** 27 (1945).

*Arnica angustifolia* Vahl, Fl. Dan. **9**[26]**:** 5 (1816).

Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11824* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8392* (Can.).

**Arnica alpina** (L.) Olin ssp. **attenuata** (Greene) Maguire in Madroño **6:** 153 (1942); Porsild in Sargentia **4:** 76 (1943), in Nat. Mus. Can. Bull. **101:** 32 (1945). See also Maguire in Brittonia **4:** 412 (1943).

*Arnica attenuata* Greene in Pittonia **4:** 170 (1900); Raup in Jour. Arn. Arb. **17:** 309 (1936).

North peak of Nahanni Mt., *Wynne-Edwards 8523* (Can.).

This subspecies has been collected in the upper Mackenzie region only in the locality cited above, but it is to be expected elsewhere. It is occasional around Athabaska and Great Slave Lakes, and Porsild has collected it in the Mackenzie delta and the Richardson Mts. Porsild also has specimens from Great Bear L. which appear to be intermediate between this and ssp. *angustifolia*.

**Arnica alpina** (L.) Olin ssp. **tomentosa** (J. M. Macoun) Maguire in Madroño **6**: 153 (1942); Porsild in Sargentia **4**: 76 (1943). See also Maguire in Brittonia **4**: 413 (1943).

*Arnica tomentosa* J. M. Macoun in Ottawa Nat. **13**: 168 (1899).

Liard R. between Nahanni Butte and Simpson, *Crickmay 113* (Can.); loose shale slide rock on south slope of Red Mt., north of Brintnell L., alt. 5500′, *9730*.

Common in the one Brintnell L. habitat noted, but not seen elsewhere; in flower early in August.

**Arnica Louiseana** Farr ssp. **frigida** (Meyer ex Iljin) Maguire in Madroño **6**: 153 (1942); Porsild in Sargentia **4**: 76 (1943), in Nat. Mus. Can. Bull. **101**: 27, 32 (1945). See also Maguire in Brittonia **4**: 417 (1943).

*Arnica frigida* Meyer ex Iljin in Trav. Mus. Bot. Acad. U. R. S. S. **19**: 112 (1926).

Dry limestone summit of Lone Mt., *Wynne-Edwards 8526* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8391* (Can.).

A western arctic subspecies, known also in the Richardson Mts., the Mackenzie delta, and at Great Bear L.

**Arnica Snyderi** sp. nov. Fig. 16.

Herba perennis, rhizomate gracili, ramuloso horizontali; culmis scaposis vel basim versus foliorum pare praeditis, pilos cellulares patentes flavo-fusco gerentibus, apicem versus lanatis, vix glandulosis, sub anthesi 6–15 cm. altis et 1–1.5 mm. crassis; foliis satis crassis, anguste ovatis vel ellipticis vel valde rhomboideo-ovatis, ad 6 cm. longis, costa prominente, pare unico nervorum lateralium satis inconspicuo, apice obtusis vel acutis, ad basim contractis, infimis petiolis alatis, supra tantum rugulosis vel breviter glanduloso-papillosis, subtus glabris pallidioribus, margine integerrimis vel raro dentibus glandulosis paucis ornatis et breviter hispido-ciliatis; foliis inferioribus culmorum basalibus similibus, superioribus valde reductis vel defectis; capitulis solitariis sub anthesi nutantibus, in fructu erectis; involucro 9–12 mm. alto, bracteis circiter 10 late lanceolatis, apice obtusis vel acutis, marginem versus purpureo-fuscis, interdum medio subviridibus, basim versus lanatis, superne extus glabris vel subglabris intus ciliato-pilosis; acheniis 4–4.5 mm. longis parce hirsutis; pappo albo; floribus disci flavis circiter 7 mm. longis basim versus villosis, lobis parce villosis, antheris flavo-fuscis; floribus radii flavis 1.5–2.2 cm. longis ad 5 mm. latis, apice breviter lobatis.

Alpine crevices and rock-slides, north slope of Colonel Mt., July 5, *9383* (Type); shale cliffs in gorge on north slope of Colonel Mt., alt. 3500′, *9823*; loose slide rock on south slope of Red Mt., alt. 5500′–5900′, *9731*; high shale slopes on west side of Terrace Mt., alt. 5500′–6000′, *9563*.

Common in the Brintnell L. area; found flowering in July and early August. This beautiful species has the single nodding heads and semi-scapose habit of the far-northwestern group which contains *A. obtusifolia* and *A. Lessingii*. It is separated from these, however, by its yellowish brown anthers and white pappus. In these characters it resembles *A. Louiseana* Farr, which has proved to be of wide range in boreal America (see Fernald in Rhod. **35**: 368–369; Porsild in Rhod. **41**: 298; Maguire, l. c.). When compared with an isotype of *A. Louiseana* at the Gray Herbarium, our plants prove to be much more scapose, with the leaves nearly or quite entire, whereas they are saliently dentate in *A. Louiseana*.

In the latter the leaves are glandular puberulent on both sides, and ovate- or obovate-lanceolate, while in *A. Snyderi* they are glabrous beneath, glabrous or sparingly glandular-papillose above, and are commonly broadly ovate to rhombic-ovate. In leaf shape they resemble some small forms of the eastern representative of *A. Louiseana* originally described by Fernald as *A. Griscomi* (Rhod. **26**: 105, 1924), but the latter, now reduced to a subspecies of *A. Louiseana,* has the char-

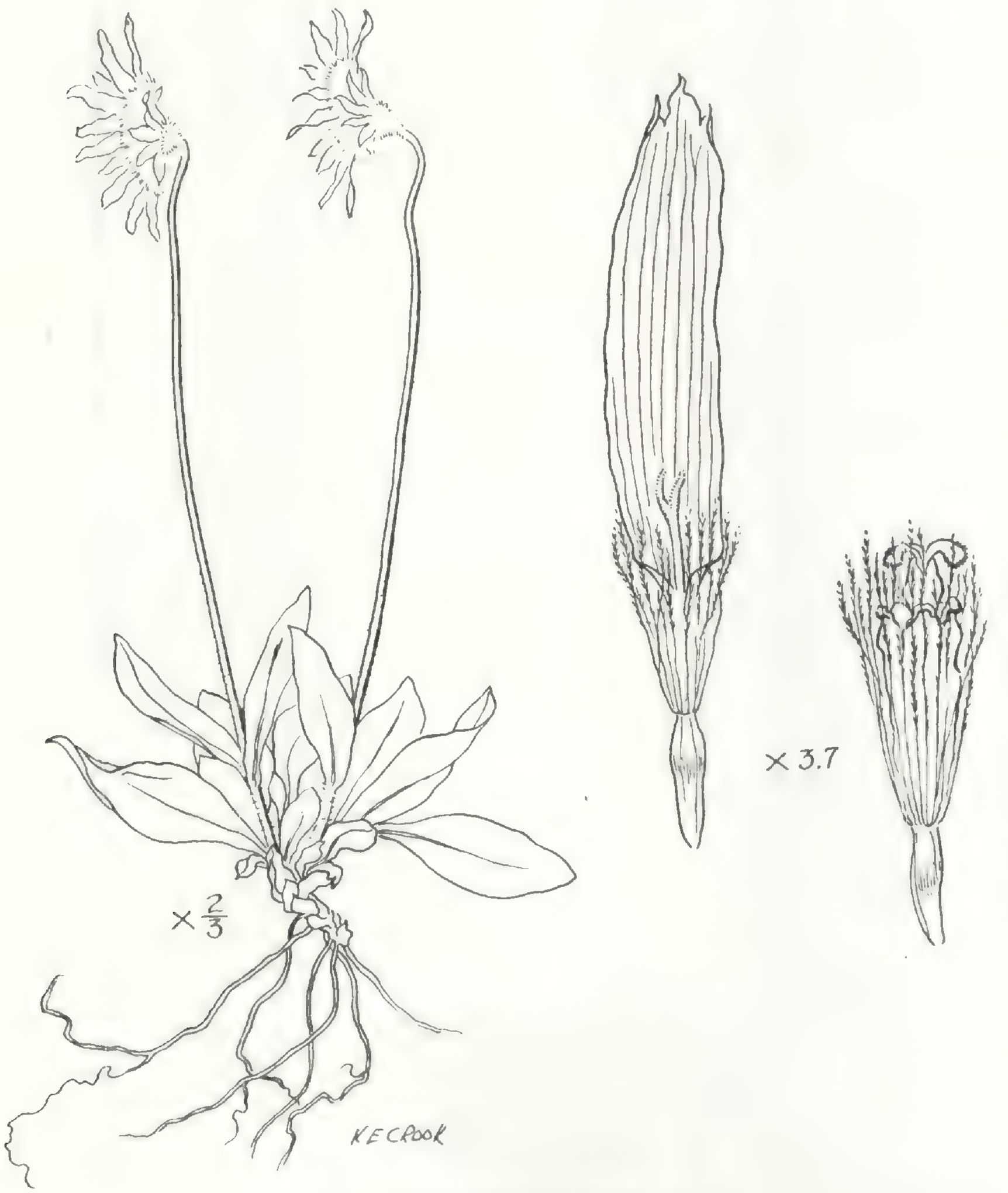


FIG. 16. *Arnica Snyderi* Raup, sp. nov.

acteristically denticulate leaves. Furthermore, our plants have the upper parts of the stem and the base of the involucre yellowish brown-lanate, while in *A. Louiseana* ssp. *Griscomi* they are merely villous or villous-hirsute with white hairs. According to Fernald (Rhod. **35**: 368) and Maguire (l. c.), *A. Louiseana* belongs in the group which centers around *A. alpina,* and its heads are not truly nodding but only bent over in drying or wilting. All of our field notes, however, state that the peduncles of *A. Snyderi* were bent while the flowers were in anthesis,

straightening later. It is true, however, that the bend is not a sharp one as in *A. Lessingii,* and it may be that our plants' affinities are with the *A. alpina* group.

**Arnica lonchophylla** Greene ssp. **genuina** Maguire in Brittonia **4:** 430 (1943); Porsild in Nat. Mus. Can. Bull. **101:** 32 (1945).

*Arnica chionopappa* sensu Raup in Jour. Arn. Arb. **17:** 309 (1936), non Fernald.

Fort Smith, *Seton & Preble 78293* (Can.); same place, *Raup 1408;* lower Slave R., *Raup 1409;* Windy Pt., Great Slave L., *Hume 102689* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Old Fort Rae, *Russell* (Can.); north peak of Nahanni Mt., *Wynne-Edwards 8524* (Can.); Lone Mt., *Wynne-Edwards 8525* (Can.).

Common in dry upland woods in the Athabaska–Great Slave L. region, but apparently rarer northward. I have seen specimens from as far north as Good Hope and Arctic Red River.

**Arnica cordifolia** Hooker ssp. **genuina** Maguire in Madroño **6:** 154 (1942).

Liard R. between Nahanni Butte and Simpson, *Crickmay 114* (Can.).

**Arnica Chamissonis** Less. ssp. **foliosa** Maguire in Rhod. **41:** 508 (1939). See also Maguire in Brittonia **4:** 463, *f. 14* (1943).

*Arnica rhizomata* A. Nels. sensu Raup in Jour. Arn. Arb. **17:** 309 (1936).

Mackenzie R., *Kennicott* (N).

The Kennicott specimen is referred to this subspecies somewhat doubtfully. Maguire (l. c.) has recorded ssp. *foliosa* for two places in southern Mackenzie, one on the south shore of Great Slave L., and the other along the Mackenzie R. near Simpson, but I have seen neither of these specimens. Maguire also has a map citation of his *A. Chamissonis* ssp. *genuina* in southwestern Mackenzie. I presume, from the position of the dot, that this is based upon material from Simpson or the Nahanni Mts. He states, however, that this is a transition region wherein it is difficult to define the subspecies.

**Arnica mollis** Hooker, Fl. Bor.-Am. **1:** 331 (1834).

Loose shale slide rock on south slope of Red Mt., alt. 5800′, *9732.*

Occasional in this habitat, but not seen elsewhere; in flower early in August.

**Arnica Lessingii** Greene in Pittonia **4:** 167 (1900); Porsild in Sargentia **4:** 76 (1943), in Nat. Mus. Can. Bull. **101:** 27 (1945). See also Maguire in Brittonia **4:** 486 (1943).

Alpine crevices and slide rock, north slope of Colonel Mt., *9383-A;* along brook on west slope of Terrace Mt., alt. 4800′, *9513;* Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8390* (Can.); Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11268* (Can.).

Common locally; in flower during early and mid-July.

**Senecio eremophilus** Richardson, Bot. App. Frankl. Journ. ed. 2, repr. 31 (1823); Hooker, Fl. Bor.-Am. **1:** 334 (1834); Macoun, Cat. Can. Pl. Pt. 2: 266 (1884); Raup in Jour. Arn. Arb. **17:** 309 (1936).

This species has not yet been collected in southwestern Mackenzie, but is to be expected there. It is occasional in the Athabaska and Slave R. lowlands, and is said by Hooker to extend northward "to Fort Franklin, on the Mackenzie River."

**Senecio triangularis** Hooker, Fl. Bor.-Am. **1:** 332, *t. 115* (1834); Porsild in Nat. Mus. Can. Bull. **101:** 28 (1945).

Damp grassy place in willow-birch scrub, upper valley of Frost Cr., North of Brintnell L., alt. 4000′, *9516.*

Abundant in the locality noted, but not seen elsewhere in the Brintnell L. area; in flower about mid-July. Porsild states that it is very common in Macmillan Pass, along the Canol Rd.

**Senecio lugens** Richardson, Bot. App. Frankl. Journ. ed. 2, repr. 31 (1823); Porsild in Nat. Mus. Can. Bull. **101**: 28, 32 (1945).

Mackenzie R., *Onion* (N); Mackenzie R. between Blackwater R. and Norman, *Crickmay 177* (Can.); wet swamps and mossy banks on shore of Brintnell L., *9323, 9345;* lowland woods and thickets at west end of Brintnell L., *9429;* alpine meadows and scrub, north slope of Colonel Mt., *9379;* shale cliffs and slides in gorge on north slope of Colonel Mt., alt. 3500′, *9820;* damp hollow in summit of Lone Mt., *Wynne-Edwards 8530* (Can.); north peak of Nahanni Mt., *Wynne-Edwards 8531* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8393* (Can.).

Common in the Mackenzie Mts. and at least occasional along the Mackenzie R.; in flower during late June and early July. Porsild noted it as common in a muskeg along a small tributary to the Little Keele R., and also in Macmillan Pass.

**Senecio cymbalarioides** Nutt. var. **borealis** (T. & G.) Greenm. in Ann. Mo. Bot. Gard. **3**: 177 (1916); Raup in Jour. Arn. Arb. **17**: 310 (1936).

*Senecio aureus* sensu Hooker, Fl. Bor.-Am. **1**: 333 (1834), in part, non L.

*Senecio aureus* L. var. *borealis* T. & G. Fl. N. Am. **2**: 443 (1841); Macoun, Cat. Can. Pl. Pt. 2: 265 (1884).

*Senecio cymbalarioides* sensu Porsild in Nat. Mus. Can. Bull. **101**: 32 (1945).

Fort Smith, *Miss E. Taylor 14790* (Can.); same place, *Seton & Preble 78580* (Can.); same place, *Raup 1424, 1429;* Windy Pt. Great Slave L., *Hume 102688* (Can.); southwest and north shores of Great Slave L., *Howe 91998* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); Mackenzie R., *Onion & Ross* (N); Providence, *Dutilly 77* (G); Liard R. between Nahanni Butte and Simpson, *Crickmay 122* (Can.); Mackenzie R. between Wrigley and Blackwater R., *Crickmay 141* (Can.); north peak of Nahanni Mt., *Wynne-Edwards 8527* (Can.).

Common in the Athabaska–Great Slave L. region and the upper Mackenzie valley.

**Senecio indecorus** Greene, Fl. Francisc. 470 (1897); Raup in Jour. Arn. Arb. **17**: 310 (1936). See Fernald in Rhod. **26**: 120 (1924).

Mackenzie R., *Onion* (N); "Mackenzie R., Ft. Franklin," *Richardson* (Can.); muskeg along road just west of Mackenzie R. near Simpson, *9900;* muskeg thickets at west end of Brintnell L., *9433, 9704.*

Occasional to common; found flowering about mid-July and early in August. Most of our plants have radiate heads. Common in the Wood Buffalo Park, but its northern limits are yet unknown.

**Senecio pauperculus** Michx. Fl. Bor.-Am. **2**: 120 (1803); Raup in Jour. Arn. Arb. **17**: 310 (1936); Porsild in Sargentia **4**: 77 (1943), in Nat. Mus. Can. Bull. **101**: 32, 34 (1945).

*Senecio aureus* sensu Hooker, Fl. Bor.-Am. **1**: 333 (1834), in part, non L.

*Senecio Balsamitae* sensu Hooker, Fl. Bor.-Am. **1**: 332 (1834), in part, non Muhl.

*Senecio aureus* L. var. *Balsamitae* sensu Macoun, Cat. Can. Pl. Pt. 2: 265 (1884), in part, non T. & G.

Lower Slave R., *Raup 1417;* Saline R., above Norman, *Wynne-Edwards 8585* (Can.); muskeg at west end of Brintnell L., *9438;* north peak of Nahanni Mt., *Wynne-Edwards 8532* (Can.).

Common in the Athabaska–Great Slave L. region, but apparently only occasional in the upper Mackenzie country. In flower about mid-July. Its known

northern limit on the Mackenzie appears to be in the neighborhood of Norman, and it has been found at Great Bear L. by Porsild.

**Senecio pauciflorus** Pursh, Fl. Am. Sept. 2: 529 (1814); Raup in Jour. Arn. Arb. 17: 310 (1936). See Fernald in Rhod. 26: 119 (1924).

*Senecio aureus* L. var. *discoideus* Hooker, Fl. Bor.-Am. 1: 333 (1834); Macoun, Cat. Can. Pl. Pt. 2: 265 (1884).

Resolution, *Harper 90128* (Can.); Rae, *Russell* (Can.).

This species is aparently only occasional at Great Slave L. and on the upper Mackenzie. I have seen only the specimens cited above, but the type of *S. aureus* var. *discoideus* came from the "Mackenzie River," according to Hooker. In the Gray Herbarium is a tracing of this type, with the label, "Mackenzie River, Fort Franklin, Dr. Richardson."

**Senecio atropurpureus** (Ledeb.) Fedtsch. in Fedtsch. & Fler. Fl. Eur. Russ. 992 (1910); Porsild in Nat. Mus. Can. Bull. 101: 27 (1945).

*Cineraria atropurpurea* Ledeb. in Mém. Acad. St. Pétersb. 5: 574 (1814).

Liard R. between Nahanni Butte and Simpson, *Crickmay 121* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8395* (Can.). Porsild states that it is common in Macmillan Pass.

**Senecio hyperborealis** Greenm. in Ann. Mo. Bot. Gard. 3: 98 (1916); Porsild in Sargentia 4: 76 (1943), in Nat. Mus. Can. Bull. 101: 32 (1945).

*Senecio resedifolius* sensu Hooker, Fl. Bor.-Am. 1: 333 (1834), in part, non Less., acc. to Greenm.

Dry summit of Lone Mt., *Wynne-Edwards 8528, 8529* (Can.).

Porsild has collected this species also on Mt. Charles along Bear R., in the Mackenzie delta, and along the arctic coast. He states that it is apparently endemic in Yukon and northwestern Mackenzie.

**Senecio Kjellmanii** A. E. Porsild in Rhod. 41: 299 (1939), Porsild in Sargentia 4: 76 (1943), in Nat. Mus. Can. Bull. 101: 27 (1945).

Bolstead Cr., Canol Rd., mi. 111 E., alpine slopes, alt. 5000′–6000′, *Wynne-Edwards 8394* (Can.).

This species was based upon *Cineraria frigida* Richardson f. *tomentosa* Kjellm., Vega Exp. Vetensk, Iakttag 2: 13, *t. 1.* (1883), the type of which came from St. Lawrence Island. Porsild records several Alaskan specimens, and a number from the Richardson Mts. west of the Mackenzie delta.

**Senecio Lindstroemii** (Ostenf.) A. E. Porsild in Nat. Mus. Can. Bull. 101: 27 (1945).

Noted by Porsild on the Little Keele R., along the Canol Rd. near mi. 60 E.

**Senecio resedifolius** Less. in Linnaea 6: 243 (1831); Porsild in Sargentia 4: 77 (1943), in Nat. Mus. Can. Bull. 101: 28 (1945).

Plains of Abraham, Canol Rd., mi. 82 E., *Porsild 11825* (Can.); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11882* (Can.); Bolstead Cr., Canol Rd., mi. 111 E., high rocky ridge, alt. 5000′–6000′, *Wynne-Edwards 8396* (Can.).

**Senecio congestus** (R. Br.) DC. var. **palustris** (L.) Fernald in Rhod. 47: 256 (1945).

*Cineraria congesta* R. Br. in Parry's 1st Voy. App. 279 (1824), in part.

*Cineraria palustris* L. Sp. Pl. ed. 2: 1243 (1763).

*Senecio palustris* (L.) Hooker, Fl. Bor.-Am. 1: 334 (1834); Macoun, Cat. Can. Pl. Pt. 2: 263 (1884); Raup in Jour. Arn. Arb. 17: 310 (1936).

Little Buffalo R., *Russell 40* (G); northwest shore of Great Slave L., *Bedford* (Can.); Mackenzie R., *Kennicott* (N).

Common in lowland sloughs, wet meadows, and mud bars along the main streams.

**Cirsium Drummondii** T. & G. Fl. N. Am. **2**: 459 (1842); Raup in Jour. Arn. Arb. **17**: 311 (1936).

*Cnicus Drummondii* Gray; Macoun, Cat. Can. Pl. Pt. 2: 270 (1884).

Clewi R., *Russell 49* (G).

This species is rather common in prairies of the Wood Buffalo Park, and there is a Richardson specimen in Herb. G marked "Ft. Franklin."

**Saussurea angustifolia** DC. in Ann. Mus. Paris **16**: 200, *t. 10–13* (1810), and Prodr. **6**: 535 (1837); Porsild in Sargentia **4**: 77 (1943), in Nat. Mus. Can. Bull. **101**: 28 (1945).

*Saussurea alpina* DC. var. *remotifolia* Hooker, Fl. Bor.-Am. **1**: 303 (1834), in part.

*Saussurea alpina* var. *Ledebouri* sensu Macoun, Cat. Can. Pl. Pt. 2: 272 (1884), in part, non Gray.

*Saussurea alpina* sensu Raup in Jour. Arn. Arb. **17**: 311 (1936), non DC.

Mackenzie R., *Hardisty* (G); Sekwi R., Canol Rd., mi. 174 E., *Porsild 11880* (Can.).

In Fl. Bor.-Am. it is stated that *S. alpina* var. *remotifolia* ranges "North of the Saskatchewan to the Bear Lake, in lat. 66° North." So far as I am aware, no *Saussurea* has been collected in the central or southern parts of the Mackenzie basin except for a single number (*J. W. Tyrell 23186,* Can.) from Great Slave L., which should be assigned to *S. angustifolia.* The Hardisty specimen could have come from anywhere on the Mackenzie R. Porsild has found *S. angustifolia* to be the common form in Keewatin, at Great Bear L., in the Mackenzie delta, and in the Richardson Mts.

**Saussurea angustifolia** DC. var. **yukonensis** A. E. Porsild in Nat. Mus. Can. Bull. **101**: 28 (1945).

Bolstead Cr., Canol Rd., mi. 111 E., high alpine ridge, alt. 6000′, *Wynne-Edwards 8403* (Can.).

This was the type collection of var. *yukonensis.* It was found with fruiting heads July 25. Porsild cites additional specimens from the Dawson Range and the Mayo district, in Yukon. The variety is distinguished by its very short stem (3–8 cm.), and by its densely crowded heads.

**Crepis elegans** Hooker, Fl. Bor.-Am. **1**: 297 (1834); Porsild in Sargentia **4**: 78 (1943), in Nat. Mus. Can. Bull. **101**: 33 (1945).

Steep shale slope of high bluff on east bank of Mackenzie R. opposite Simpson, *9940;* outwash gravel plain near mouth of N. Nahanni R., *Wynne-Edwards 8542* (Can.); Norman, *Coll.?* (N).

Common at the Simpson locality; achenes maturing in late August. Porsild has collected it also along the Bear R.

**Crepis nana** Richardson, Bot. App. Frankl. Journ. 746 (1823); Porsild in Sargentia **4**: 78 (1943), in Nat. Mus. Can. Bull. **101**: 28 (1945).

Mackenzie R., *McFarlane* (N); gravel fan at base of a granite mountain west of Brintnell L., *9476;* shale rock-slides, north slope of Colonel Mt., alt. 5000′–6000′, *9402, 9650;* Bolstead Cr., Canol Rd., mi. 111 E., *Wynne-Edwards 8400* (Can.).

Common in alpine slide rock; in flower during middle and late July.

**Hieracium canadense** Michx. Fl. Bor.-Am. **2**: 86 (1803); Raup in Jour. Arn. Arb. **17**: 311 (1936); Porsild in Sargentia **4**: 78 (1943), in Nat. Mus. Can. Bull. **101**: 34 (1945).

*Hieracium umbellatum* L. sensu Hooker, Fl. Bor.-Am. **1**: 300 (1834); Macoun, Cat. Can. Pl. Pt. 2: 275 (1884).

Southwest and north shores of Great Slave L., *Howe 91997* (Can.); northwest shore of Great Slave L., *Bedford* (Can.); east shore of Trout L., *C. O. Hage* (G); Simpson, *Onion* (N); sandy roadway in upland woods west of Mackenzie R. near Simpson, *9892;* in silty soil near Mackenzie R. at Simpson, *Nowosad* (Can.); Mackenzie R. between Wrigley and Blackwater R., *Crickmay 144* (Can.); Saline R., above Norman, *Wynne-Edwards 8586* (Can.).

Occasional to common; collected with flowers and mature achenes Aug. 24. Noted in Fl. Bor.-Am. as occurring "From Lake Huron . . . to Fort Franklin, on the Mackenzie River, in lat. 66°, north, abundant." Porsild has collected it in recent years on Mt. Charles and at Great Bear L.

**Hieracium gracile** Hooker, Fl. Bor.-Am. **1:** 298 (1834); Porsild in Sargentia **4:** 78 (1943), in Nat. Mus. Can. Bull. **101:** 28 (1945).

Turfy shale slopes on north side of Colonel Mt., alt. 4300′, *9649;* rocky stream bed in upper valley of Frost Cr., alt. 4300′, *9546;* east slope of Red Mt., alt. 4300′–5000′, *9734;* Macmillan Pass, Canol Rd., mi. 225 E., *Porsild 11267* (Can.).

Occasional in the Brintnell L. region; found with flowers and maturing achenes in middle and late July. Part of our material, notably no. *9734*, seems to be intermediate between *H. gracile* and the very hairy *H. triste* Willd. It appears to be nearest, however, to the former. See Hultén, Fl. Aleut. Isl. 340.

**Taraxacum alaskanum** Rydb. in Bull. Torr. Bot. Cl. **28:** 512 (1901); Porsild in Sargentia **4:** 77 (1943), in Nat. Mus. Can. Bull. **101:** 28 (1945).

Mackenzie R. between Blackwater R. and Norman, *Crickmay 173* (Can.); gravelly thicket at Camp Pt., Brintnell L., *9320;* sandy plain near west end of Brintnell L., *9455;* among rocks along small brook on west slope of Terrace Mt., alt. 4800′–5500′, *9558;* Bolstead Cr., Canol Rd., mi. 111 E., alpine ridge, alt. 6000′, *Wynne-Edwards 8401* (Can.).

Rare at Brintnell L., and noted by Porsild as rare also in Macmillan Pass, where it inhabits river bars. Found flowering at Brintnell L. in late June and mid-July, and with ripe achenes July 18. Porsild has collected it also in the Richardson Mts. and at the Mackenzie delta.

**Taraxacum ceratophorum** (Ledeb.) DC. Prodr. **7:** 146 (1838); Raup in Jour. Arn. Arb. **17:** 311 (1936). See Fernald in Rhod. **35:** 373 (1933).

*Leontodon ceratophorus* Ledeb. Icon. Pl. Fl. Ross. **1:** 9, *t. 34* (1829).

Mackenzie R., *Onion* (N) ?; Mackenzie R. between Blackwater R. and Norman, *Crickmay 175* (Can.); gravelly thickets near shore of Brintnell L. at Camp Pt., *9367;* muskeg thickets near west end of Brintnell L., *9444-A.*

Occasional at Brintnell L.; collected with flowers and maturing achenes in the first two weeks of July.

**Taraxacum lacerum** Greene in Pittonia **4:** 230 (1901); Raup in Jour. Arn. Arb. **17:** 312 (1936); Porsild in Sargentia **4:** 77 (1943), in Nat. Mus. Can. Bull. **101:** 33 (1945). See Fernald in Rhod. **35:** 378 (1933).

Outwash gravel plain near mouth of North Nahanni R., *Wynne-Edwards 8541* (Can.); gravelly thickets on shore of Brintnell L. at Camp Pt., *9319;* mossy muskeg at west end of Brintnell L., *9441.*

Occasional or common in the above habitats; achenes maturing in late June and early July. Our no. *9441* has many of the involucral bracts ecorniculate, resembling *T. lapponicum* in this respect. It is therefore placed here provisionally.

**Taraxacum lapponicum** Kihlm. in Meddel. Soc. Faun. Fl. Fenn. **11:** 108 (1884); Raup in Jour. Arn. Arb. **17:** 312 (1936). See Fernald in Rhod. **35:** 383 (1933).

Gravel plain near west end of Brintnell L., *9457;* muskeg thickets near west end of Brintnell L., *9444.*

Common in the muskeg habitat; achenes maturing in the second week of July.

**Lactuca pulchella** (Pursh) DC. Prodr. **7**: 134 (1838); Macoun, Cat. Can. Pl. Pt. **2**: 281 (1884); Raup in Jour. Arn. Arb. **17**: 312 (1936).

*Sonchus pulchellus* Pursh, Fl. Am. Sept. **2**: 502 (1814).

*Sonchus sibiricus* sensu Hooker, Fl. Bor.-Am. **1**: 293 (1834), non L.

Lower Slave R., *Raup 1444;* open fields at Simpson, *9852;* Mackenzie R. between Blackwater R. and Norman, *Crickmay 178* (Can.); Bear R., *Miss E. Taylor 89* (Can.).

Common on stream banks and in clearings throughout the Mackenzie basin northward at least to Norman. At Simpson it was found with flowers and maturing achenes Aug. 21.

**Sonchus oleraceus** L. Sp. Pl. 794 (1753).

Weed in a cultivated field on the west bank of the Mackenzie R. near Simpson, *9931.*

Occasional; found with flowers and mature achenes Aug. 24.

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## EXPLANATION OF PLATES

### Plate I

Air view of Brintnell Lake and vicinity, looking south, with South Nahanni River in valley at left. (Reproduced through the courtesy of the Department of National Defense, Ottawa, Canada.)

### Plate II

(Upper) Aerial photo of mountains along upper South Nahanni River. Note ancient erosion surface in foreground.

(Lower) Air view of Simpson and the Mackenzie River, looking west. Note abandoned channels on the island flood plain, and semi-open grasslands on the upland west of the river. (Reproduced through the courtesy of the Department of National Defense, Ottawa, Canada.)

### Plate III

(Upper) View of western end of Brintnell Lake; Red Mt. at right and Mt. Harrison Smith at left. Frost Creek enters at the right. Note contrast between shale and granite slopes.

(Lower) Panorama from summit of Red Mt., alt. about 5900 feet. The views extend from northwest through northeast, and to southeast. The valley in the central part is the upper valley of Frost Creek, and the mountain immediately back of it is Terrace Mt. The distant valley at the right is that of the South Nahanni River. Note the expanse of subalpine scrub on the till terrace just east of Frost Creek.

### Plate IV

(Upper) View of Brintnell Lake from near summit of Red Mt., showing truncated hogbacks and fans on the north slope of Colonel Mt. Note shoulders of old till just above timber line at the right of the photo (see Plate V).

(Lower) Glacier and valley west and southwest of Brintnell Lake. View from south slope of Red Mt.

### Plate V

Exposure of cemented till on north slope of Colonel Mt., alt. about 3800 feet.

### Plate VI

(Upper) Bank of unconsolidated till in upper valley of Frost Creek, alt. about 4400 feet.
(Lower) Stone rings in upper valley of Frost Creek, alt. about 4500 feet.

### Plate VII

(Left) Forest of white spruce (*Picea glauca* var. *albertiana*) on fan at mouth of Frost Creek (Camp Point).

(Right) Forest of white spruce and birch (*Betula papyrifera* vars. *commutata* and *humilis*) in old burn on lower south slope of Red Mt., back of Camp Point.

### Plate VIII

(Left) Open forest of white spruce (*Picea glauca* var. *Porsildii*) near timber line on south-facing slope of Red Mt., alt. about 4000 feet. The predominant grass in the foreground is *Festuca altaica*.

(Right) Open forest of black spruce (*Picea mariana*) on north slope of Colonel Mt., alt. about 3200 feet.

### Plate IX

Partially stabilized slide rock on north slope of Colonel Mt. View from an altitude of about 4800 feet. Note turf-banked terraces and stone stripes.

### Plate X

(Upper) View northwest across upper valley of Frost Creek, from an altitude of about 5000 feet on the west slope of Terrace Mt. Note rounded alpine surfaces of shale mountains in contrast to rugged granite peaks.

(Lower) Cliffs just below summit on north slope of Red Mt.

### Plate XI

(Upper) Mud flat at western end of Brintnell Lake, showing association of *Eriophorum Scheuchzeri* and *Juncus castaneus*.

(Lower) Natural prairie opening on the upland west of the Mackenzie River near Simpson (see Plate II).

### Plate XII

(Left) *Picea glauca* var. *Porsildii*.

(Right) *Picea glauca* var. *albertiana*.

Both photographs were taken on the gravel fan at Camp Point, Brintnell Lake. Note differences in the forms of the trees and the texture of the bark.

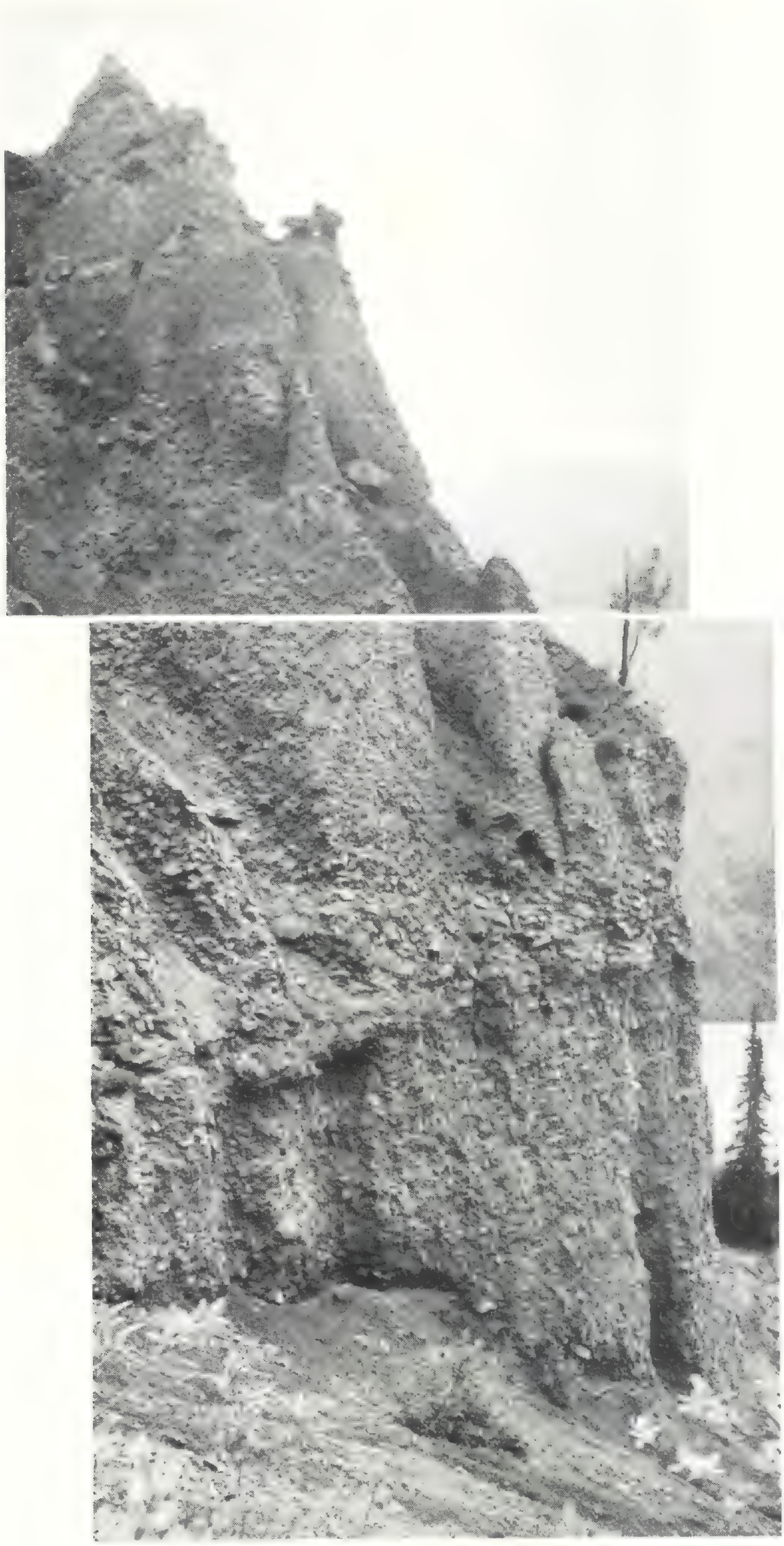
### Plates XIII–XXXVII

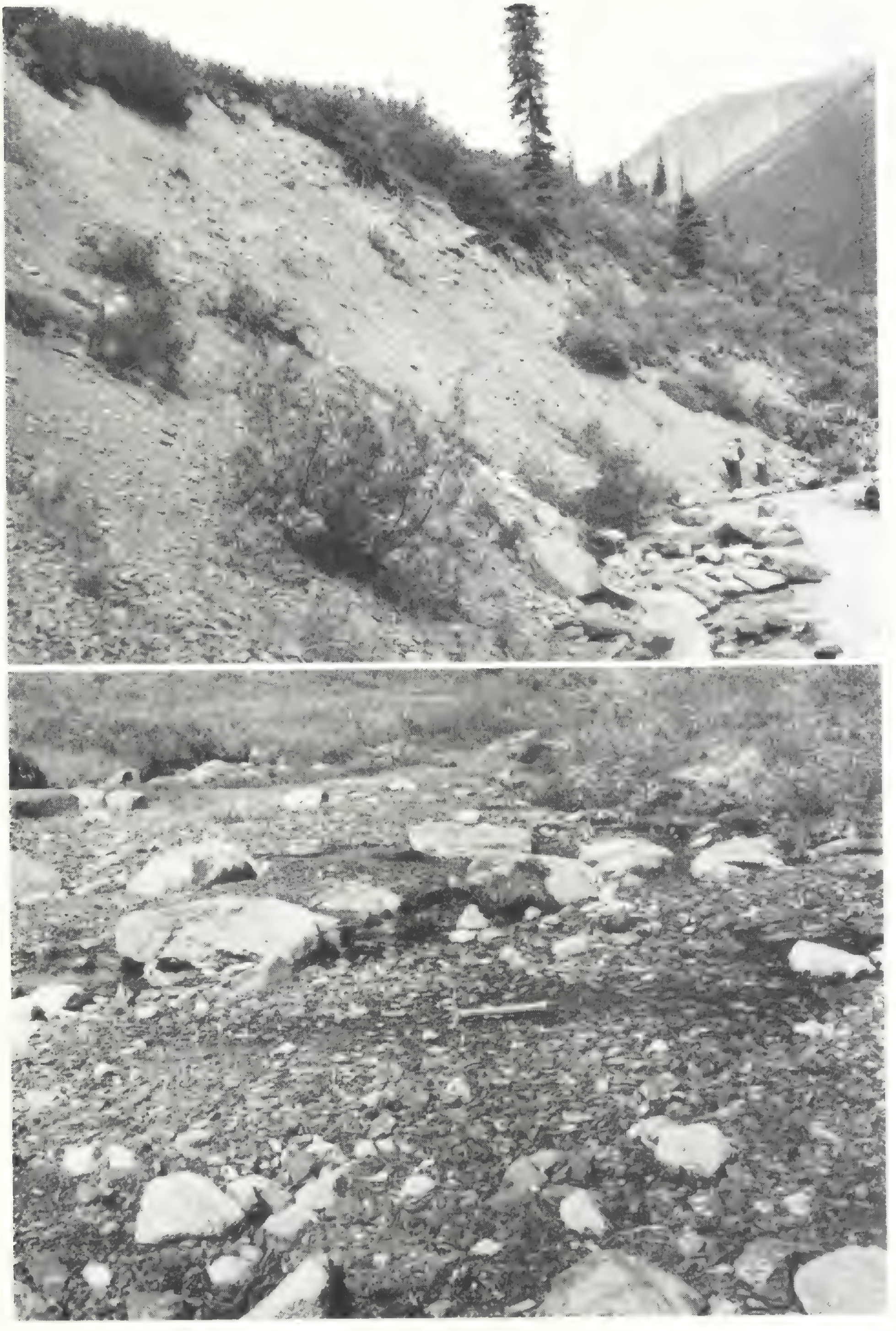
Distribution maps of species as indicated. These maps represent the entire known vascular flora of the Brintnell Lake area with the exception of 12 species which are of very limited local range or are described as new in this paper.

The Botany of Southwestern Mackenzie

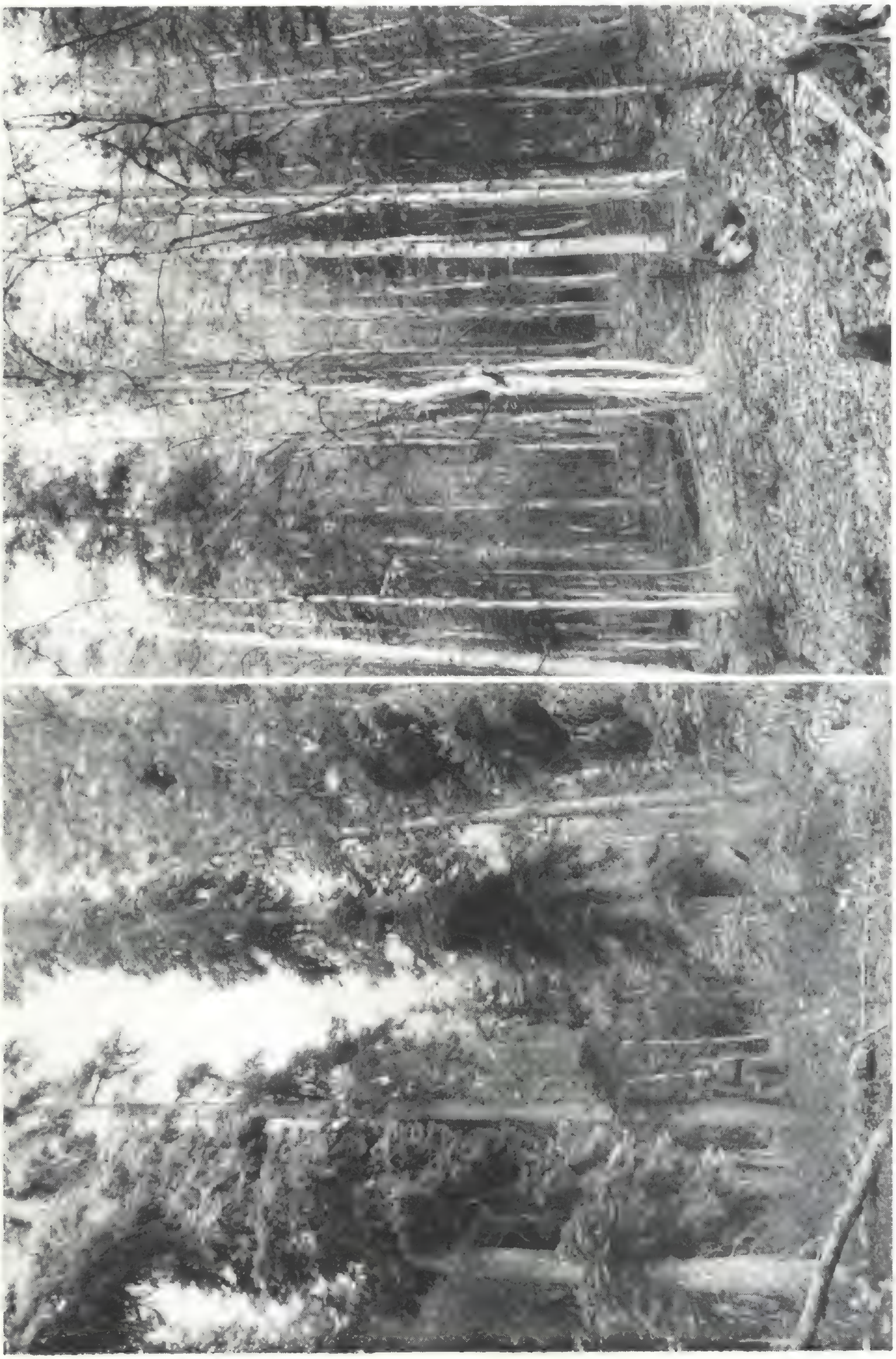
THE BOTANY OF SOUTHWESTERN MACKENZIE

The Botany of Southwestern Mackenzie





THE BOTANY OF SOUTHWESTERN MACKENZIE



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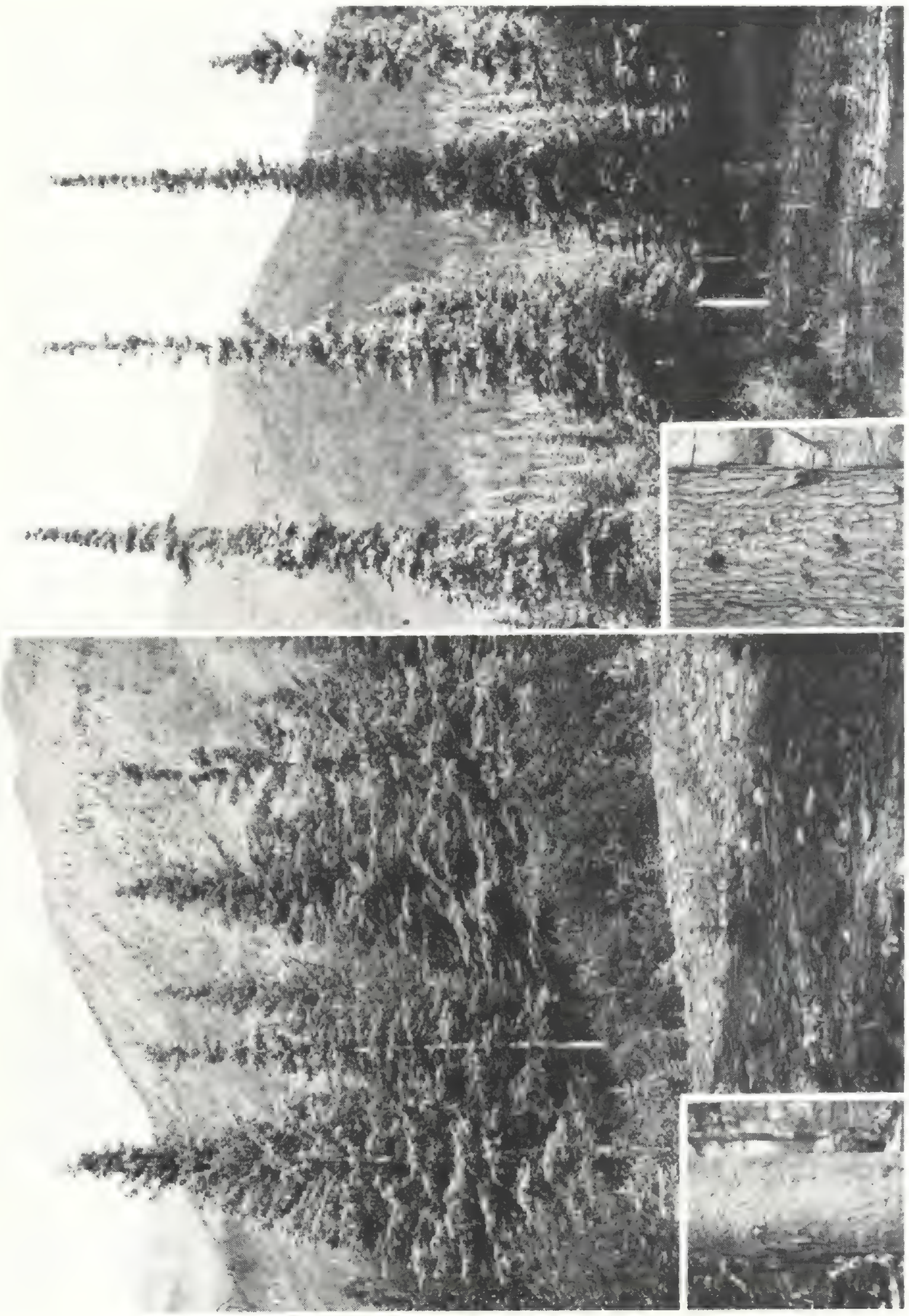
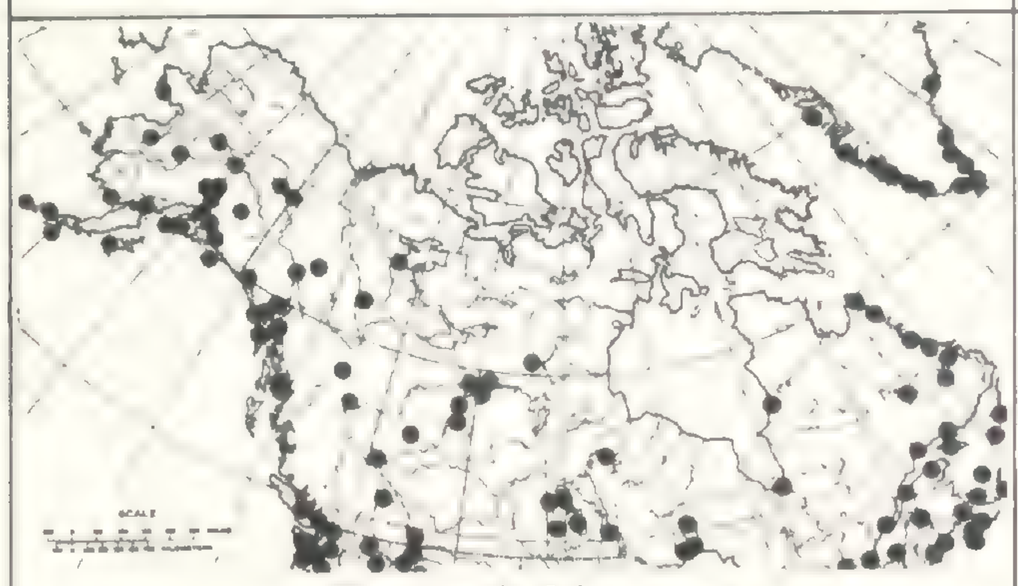


THE BOTANY OF SOUTHWESTERN MACKENZIE

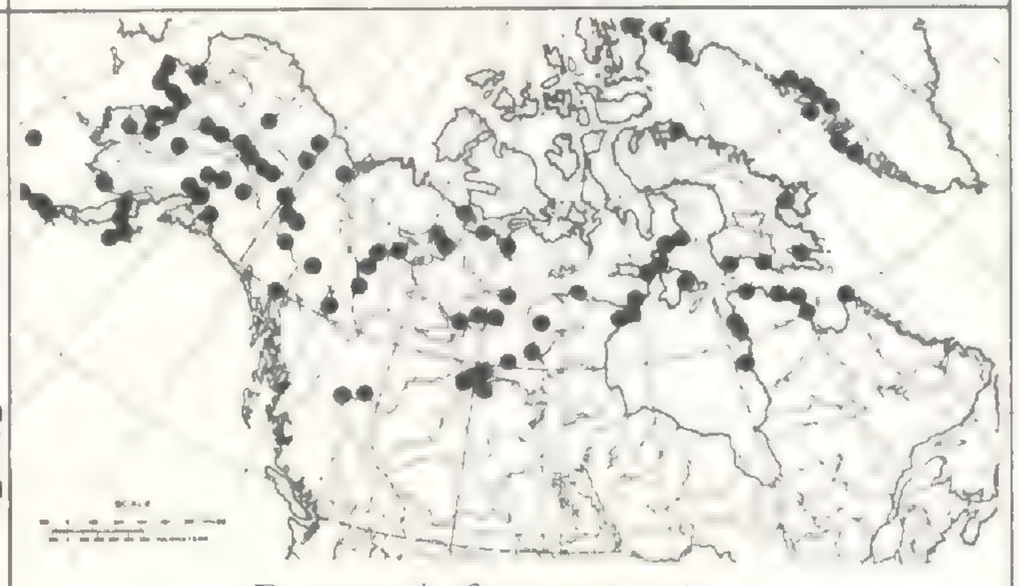
*Woodsia ilvensis*



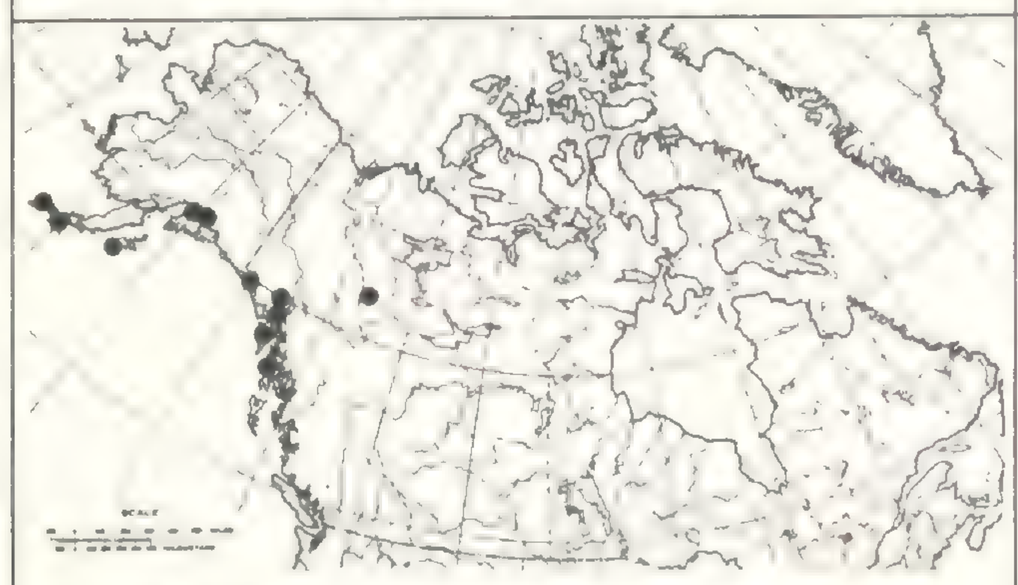
*Cystopteris fragilis*



*Dryopteris Linnaeana*

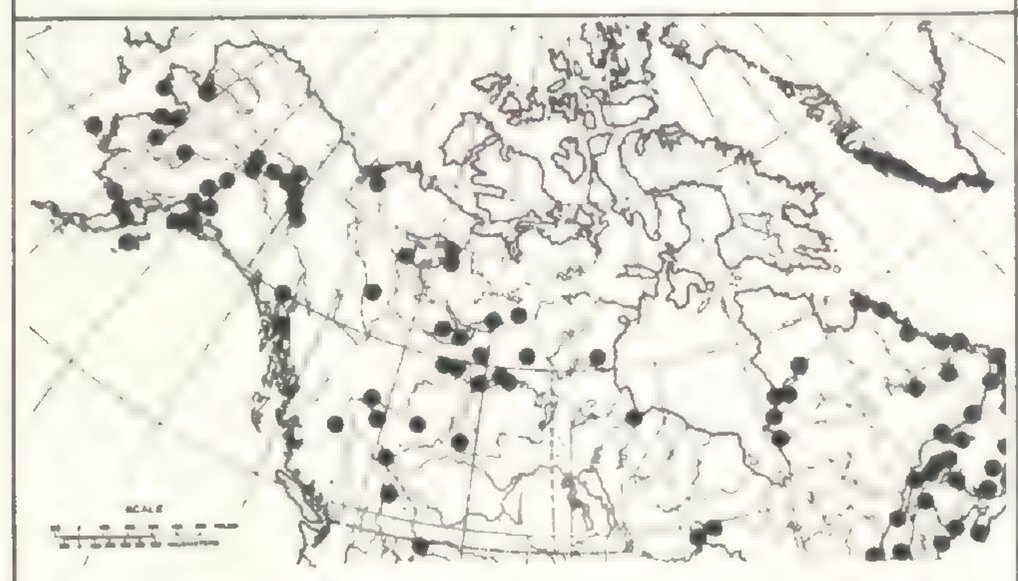


*Dryopteris fragrans s.str.*

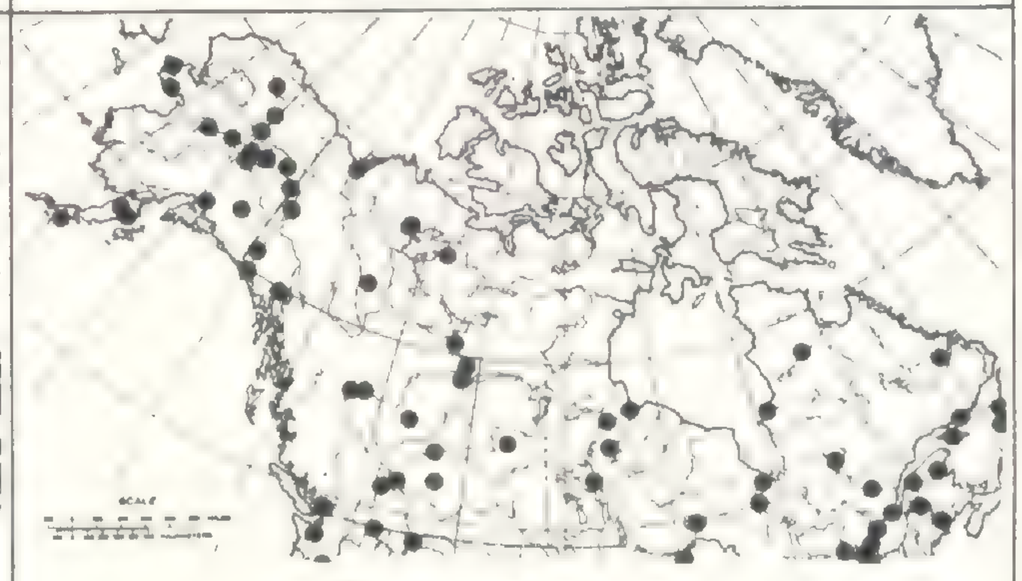


*Cryptogramma crispa var. sitchensis*

*Equisetum arvense*

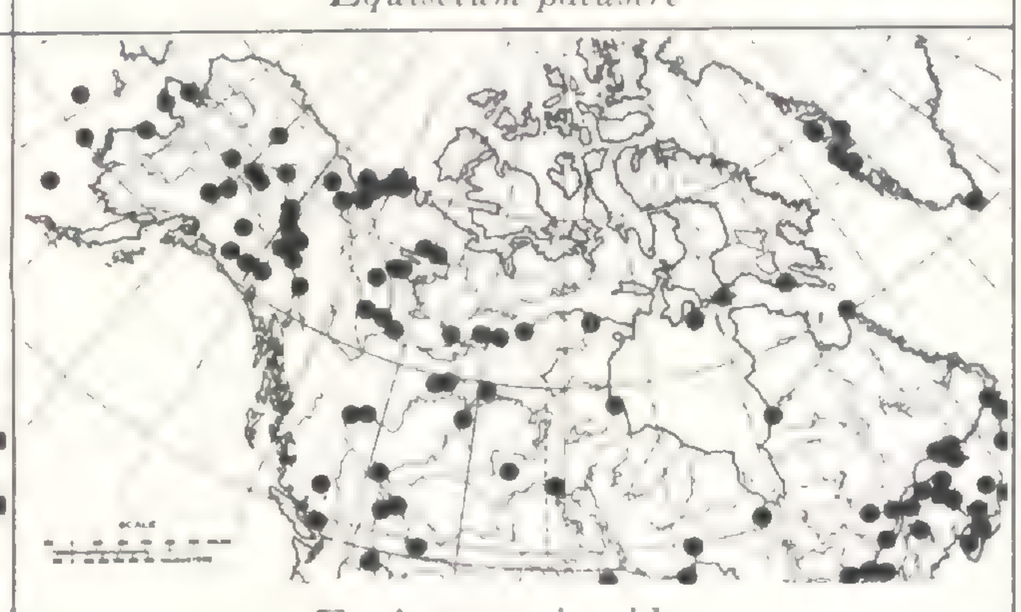


*Equisetum sylvaticum s.l.*

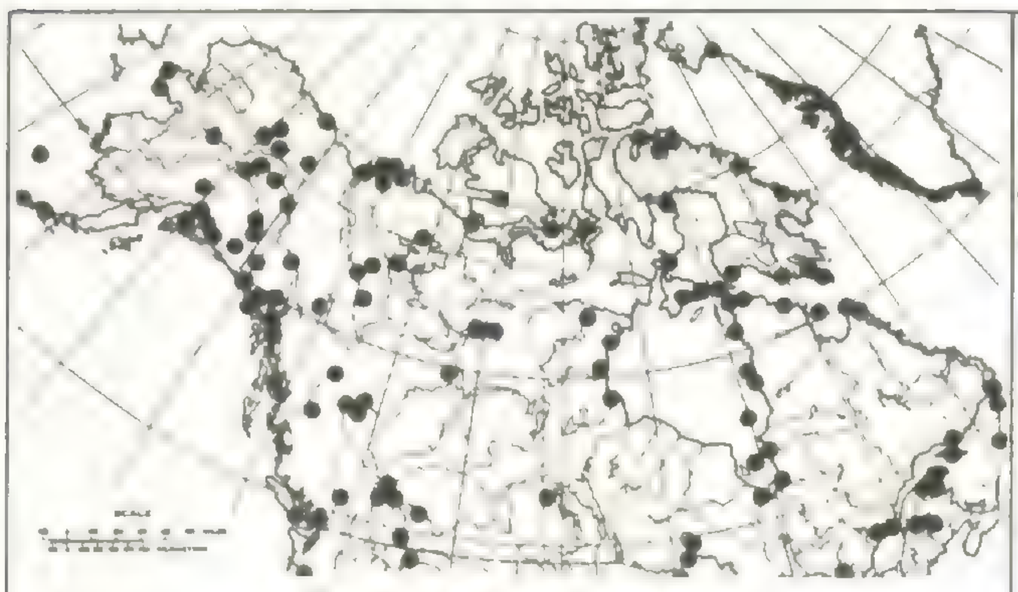


*Equisetum palustre*

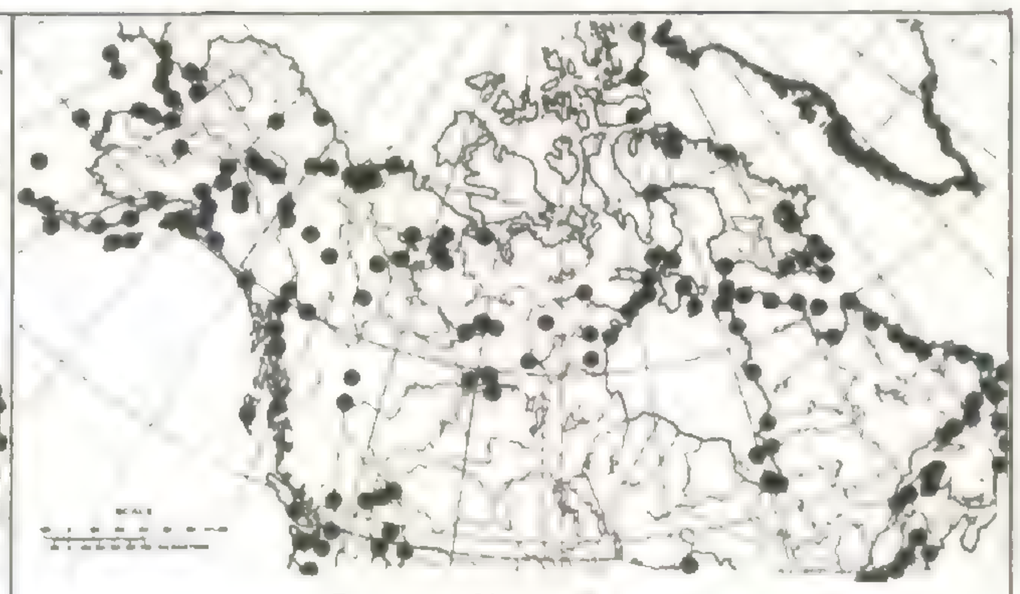
*Equisetum fluviatile*



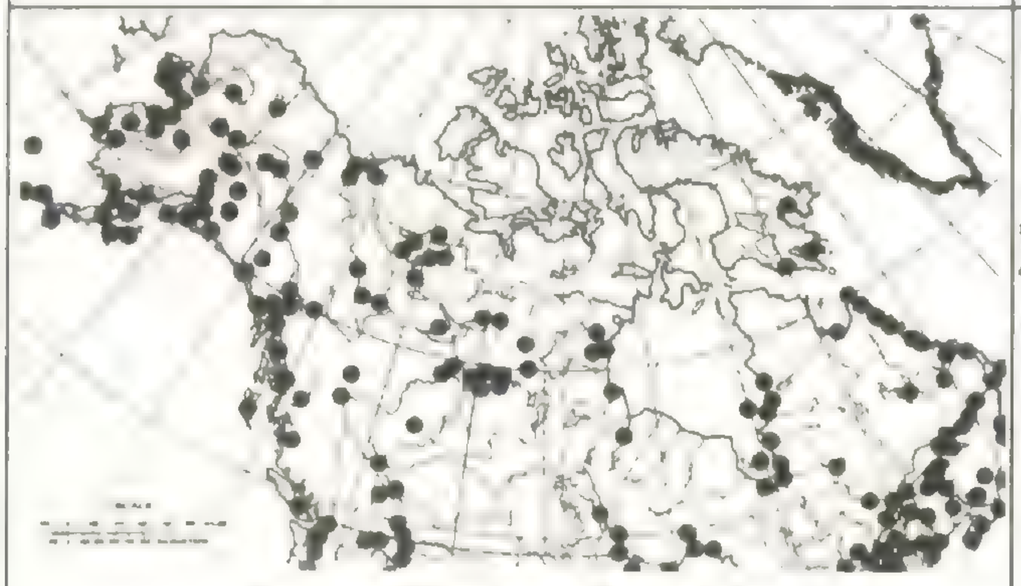
*Equisetum scirpoides*



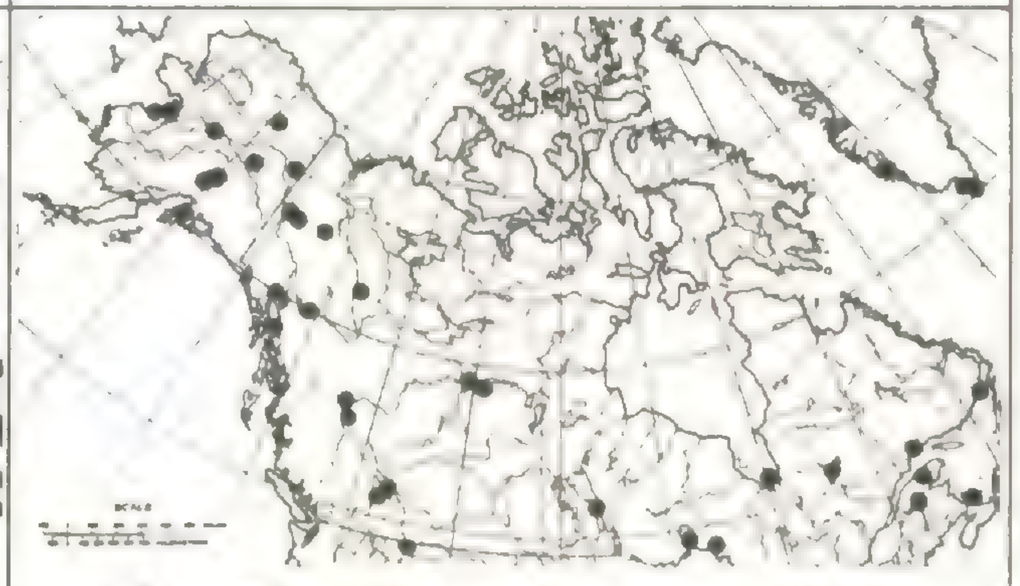
*Equisetum variegatum*



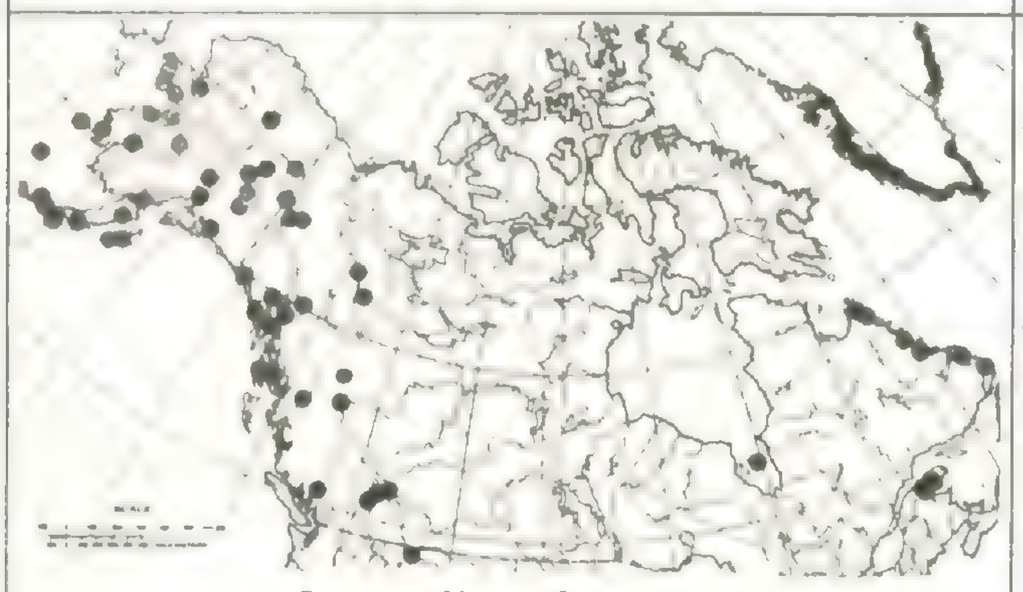
*Lycopodium Selago*



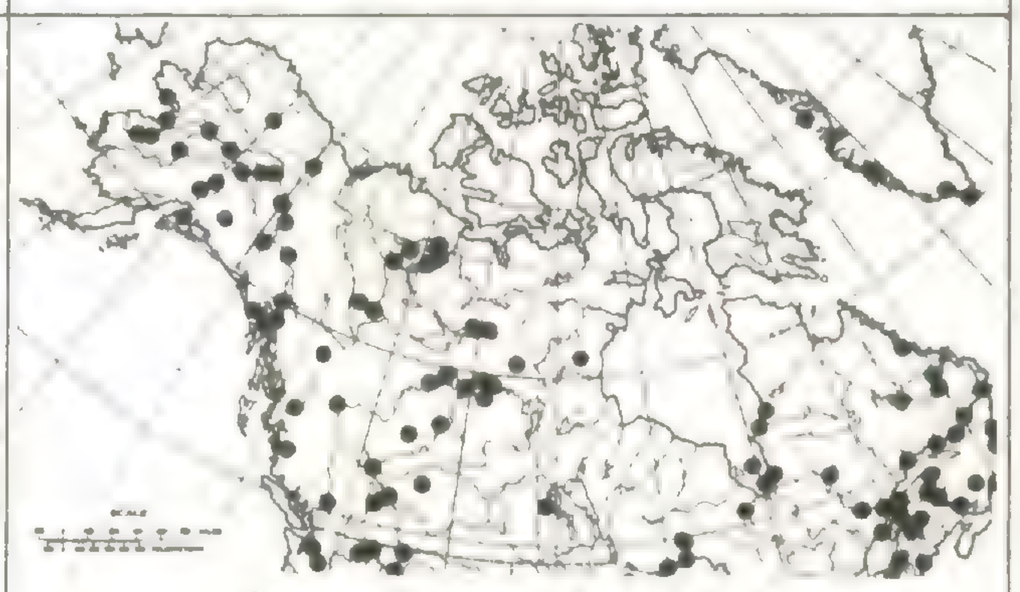
*Lycopodium annotinum s.l.*



*Lycopodium clavatum var. monostachyon*



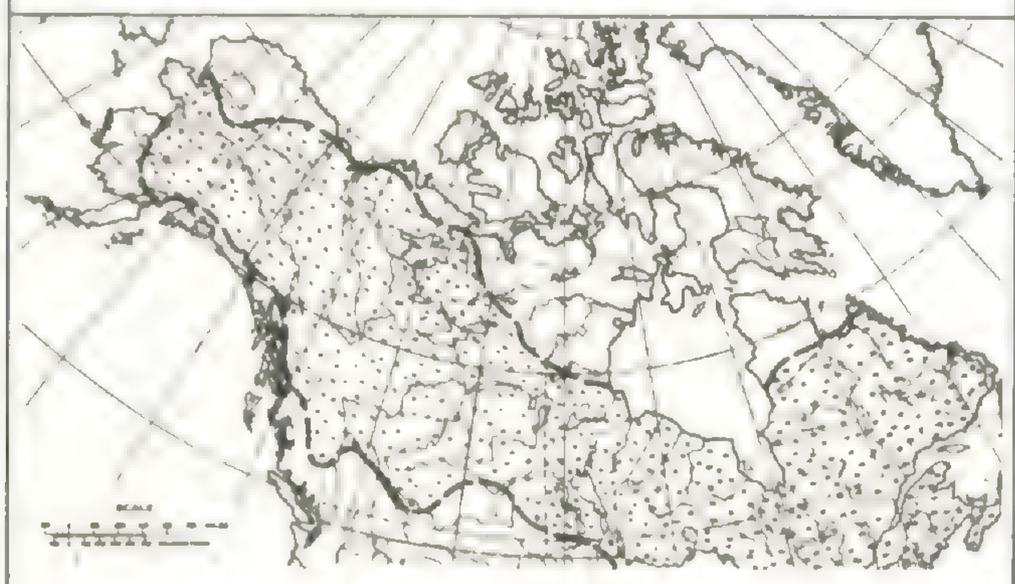
*Lycopodium alpinum*



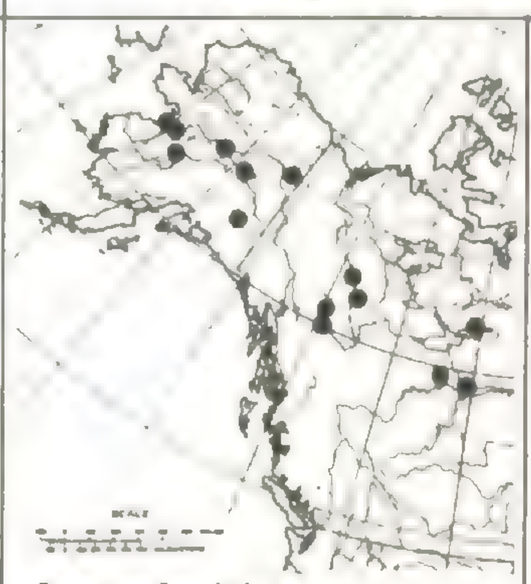
*Lycopodium complanatum*

*Selaginella selaginoides*

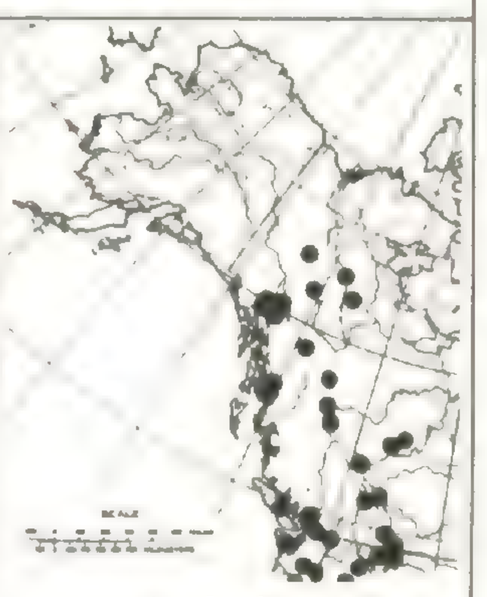
*Picea glauca incl. var. albertiana*



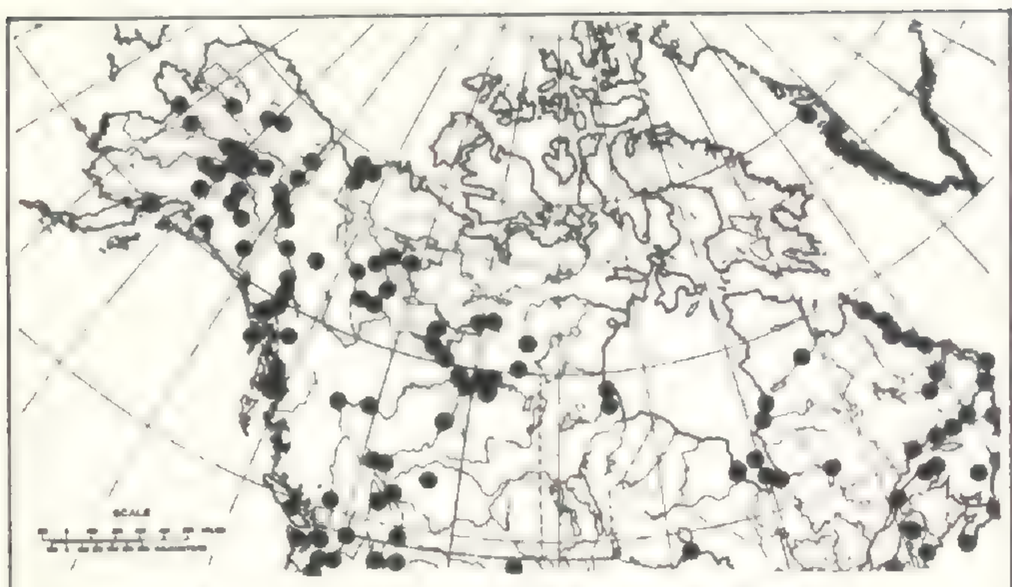
*Picea mariana*



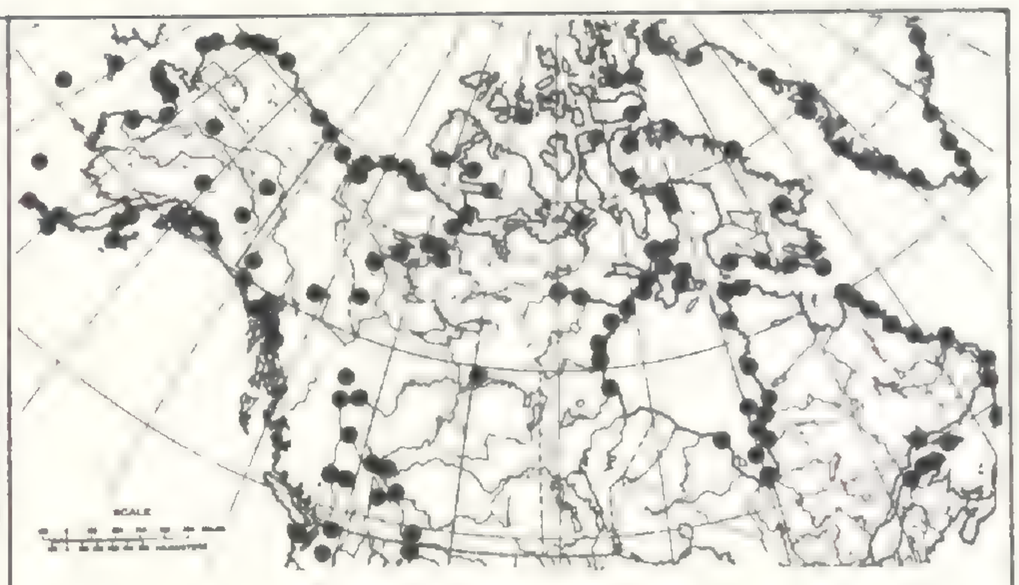
*Larix laricina var. alaskensis*



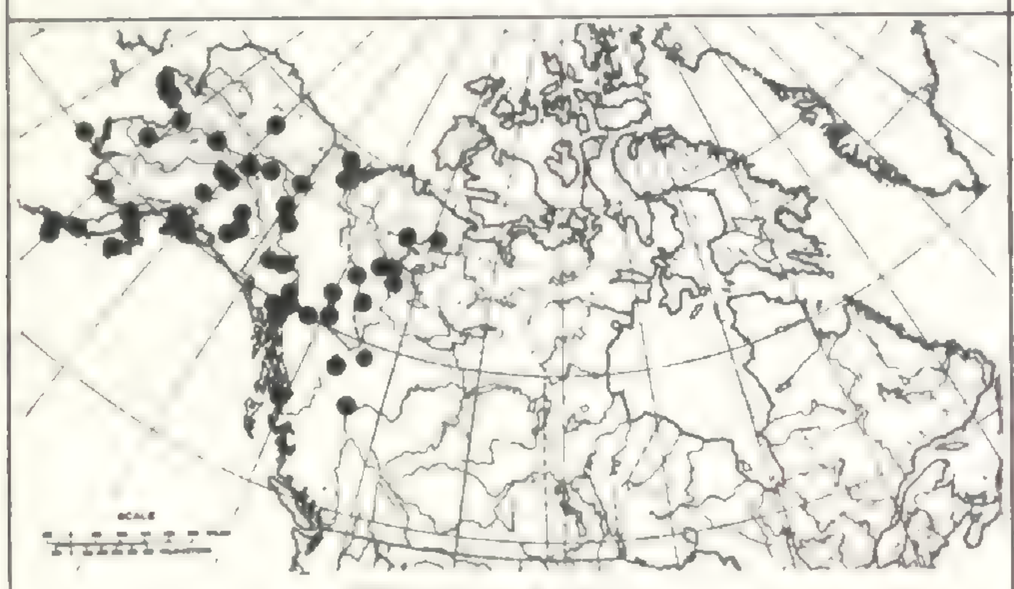
*Abies lasiocarpa*



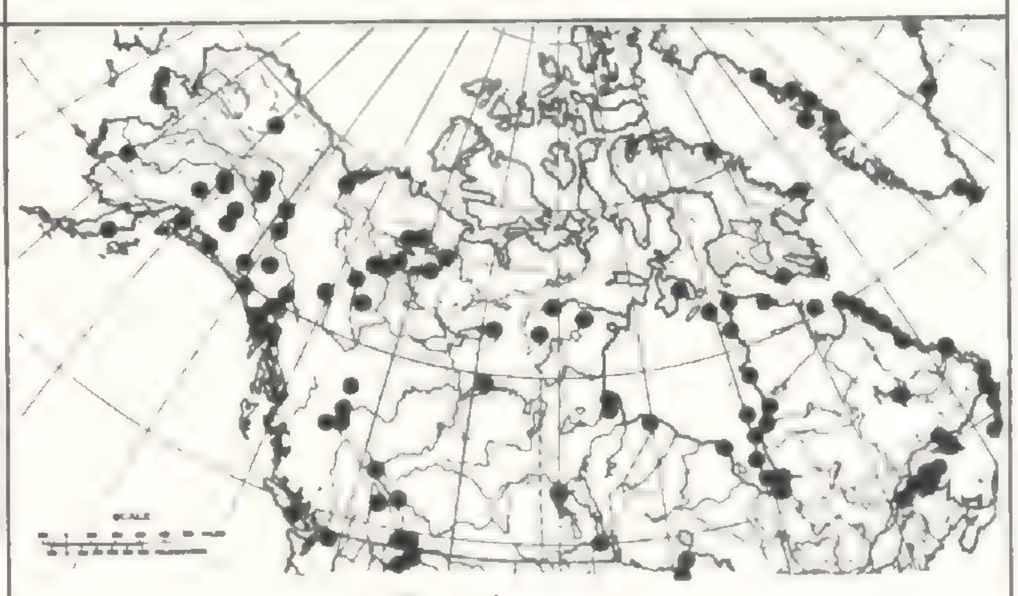
*Juniperus communis var. montana*



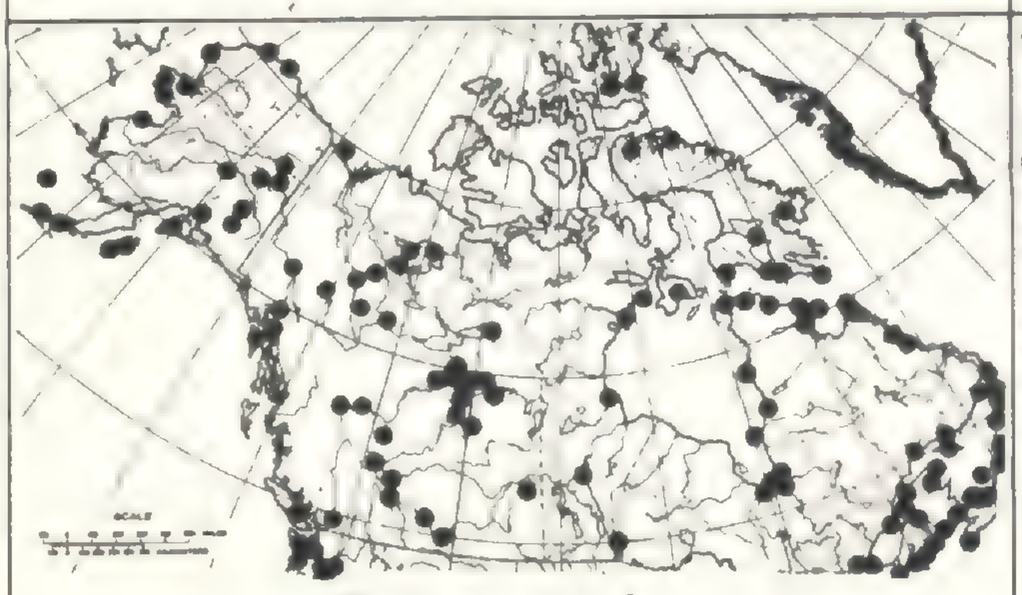
*Festuca brachyphylla*



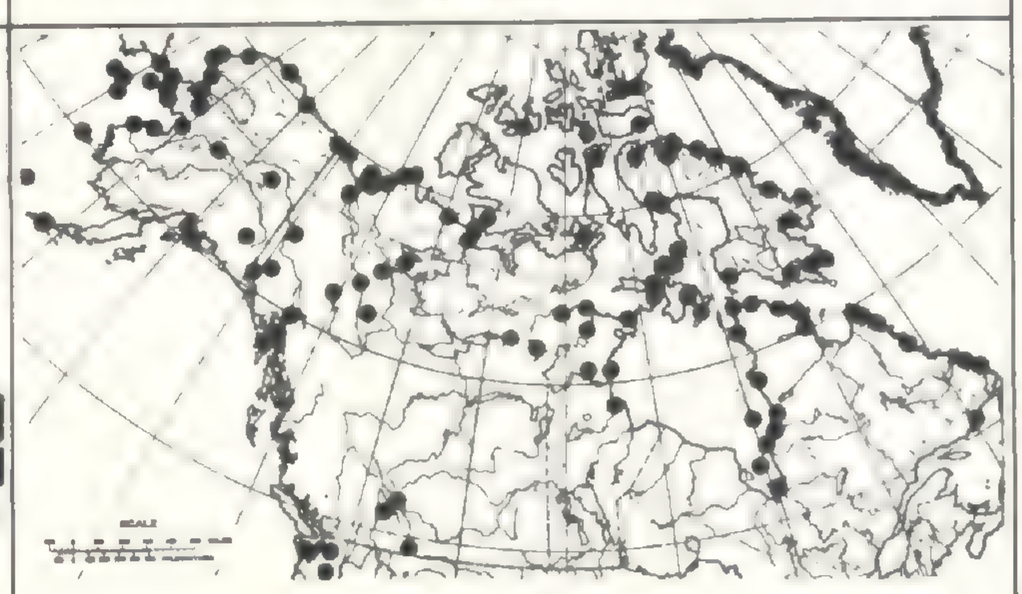
*Festuca altaica*



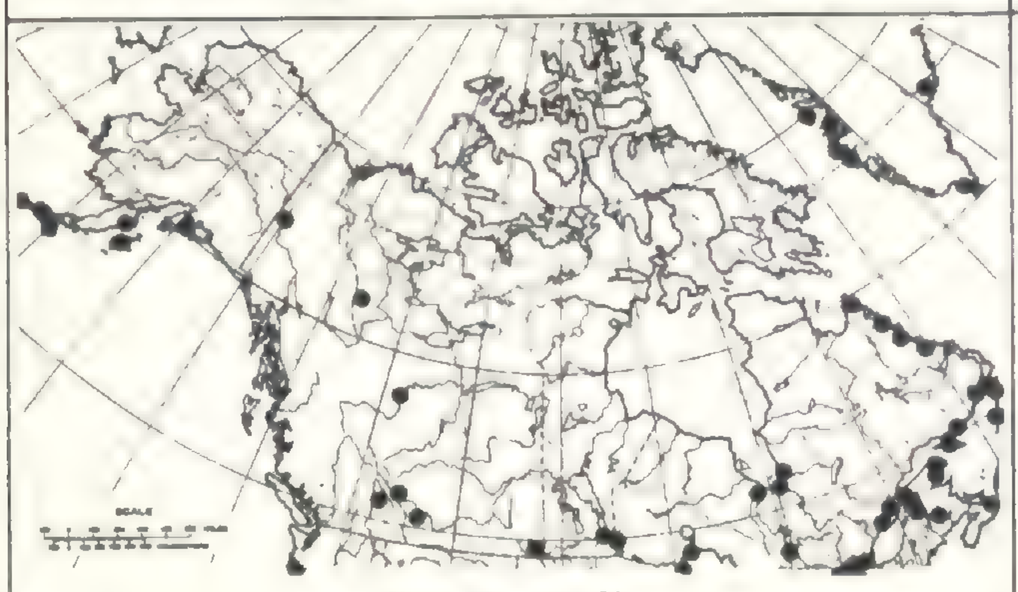
*Poa alpina*



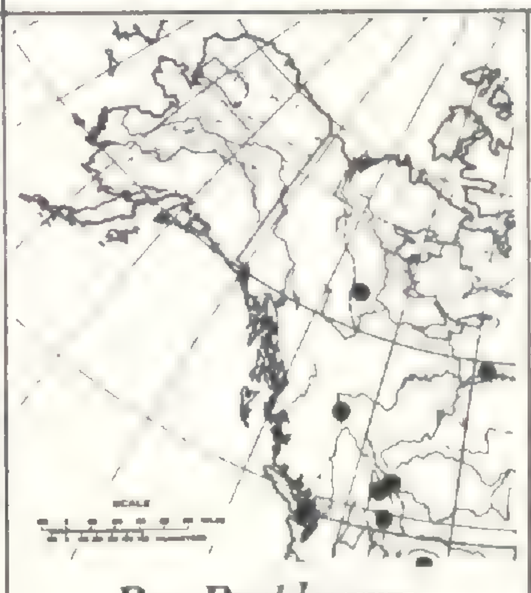
*Poa pratensis s.l.*



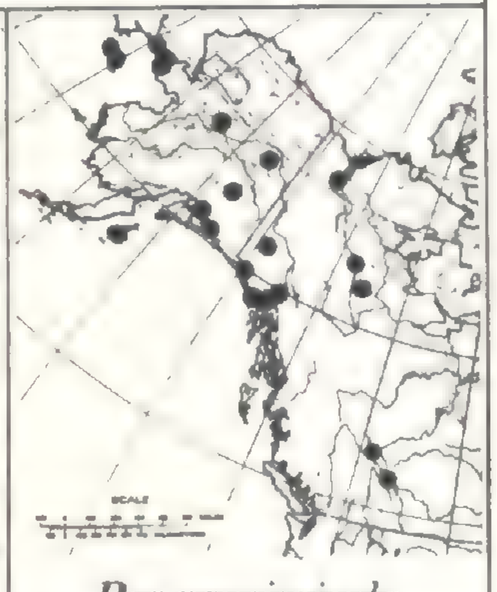
*Poa arctica*



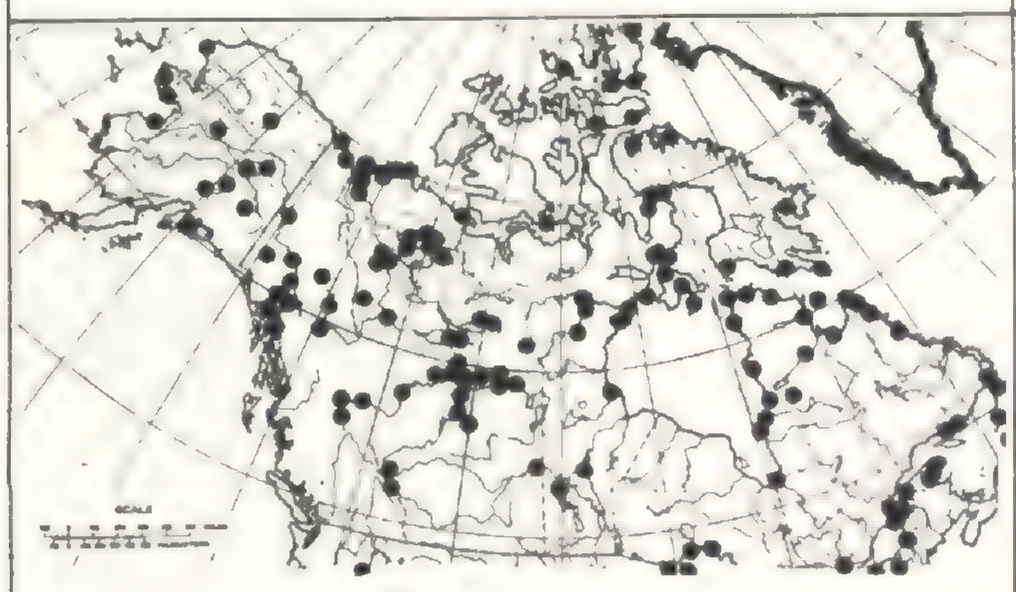
*Poa nemoralis*



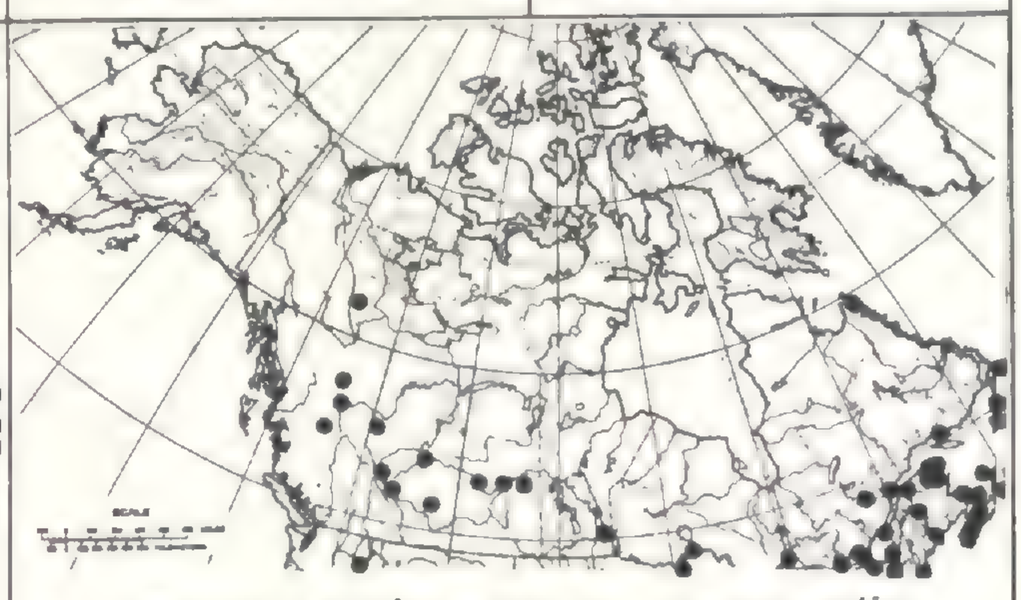
*Poa Buckleyana*



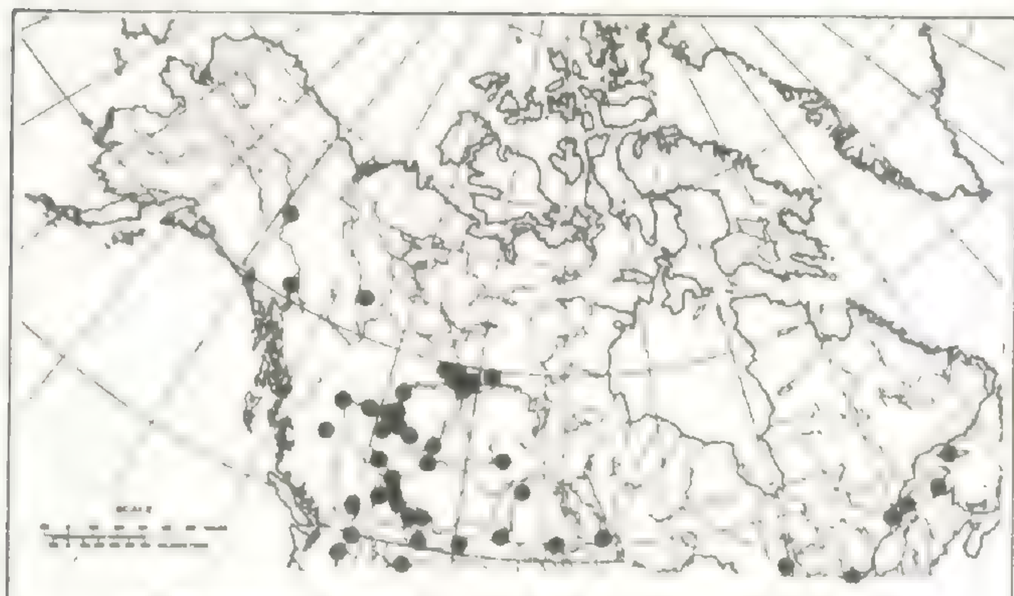
*Poa paucispicula*



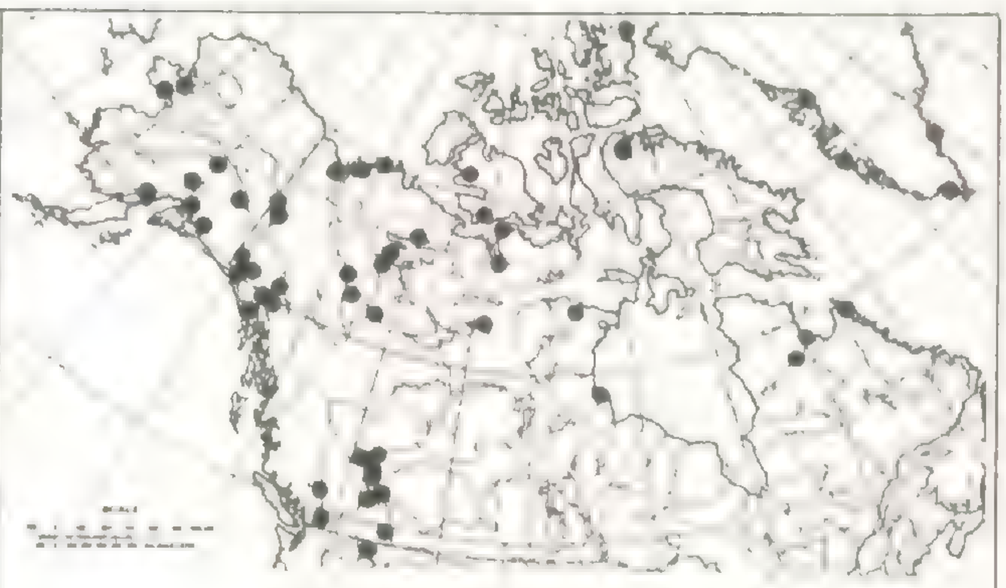
*Poa glauca*



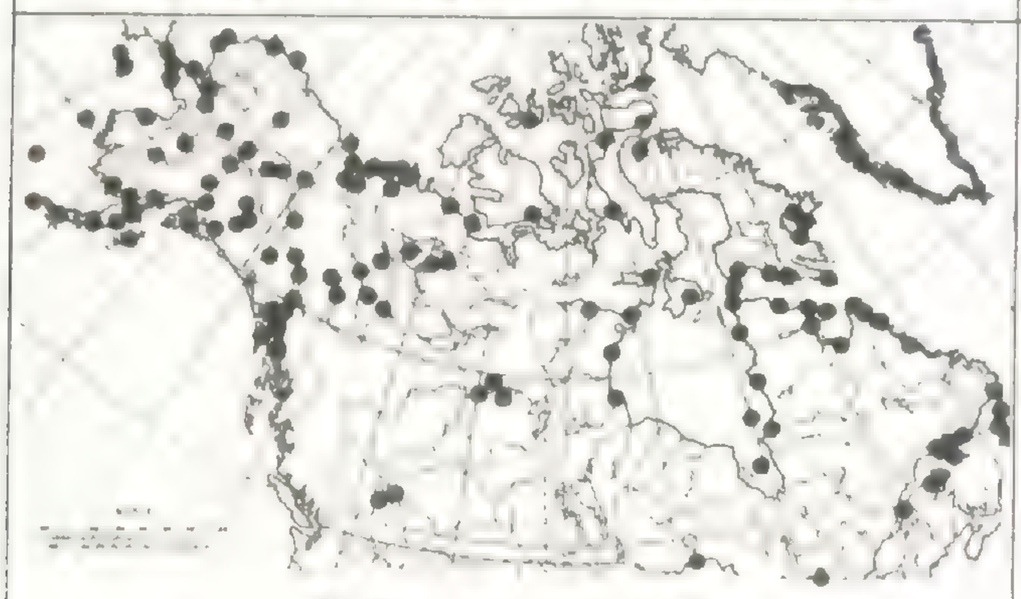
*Agropyron trachycaulum var. novae-angliae*



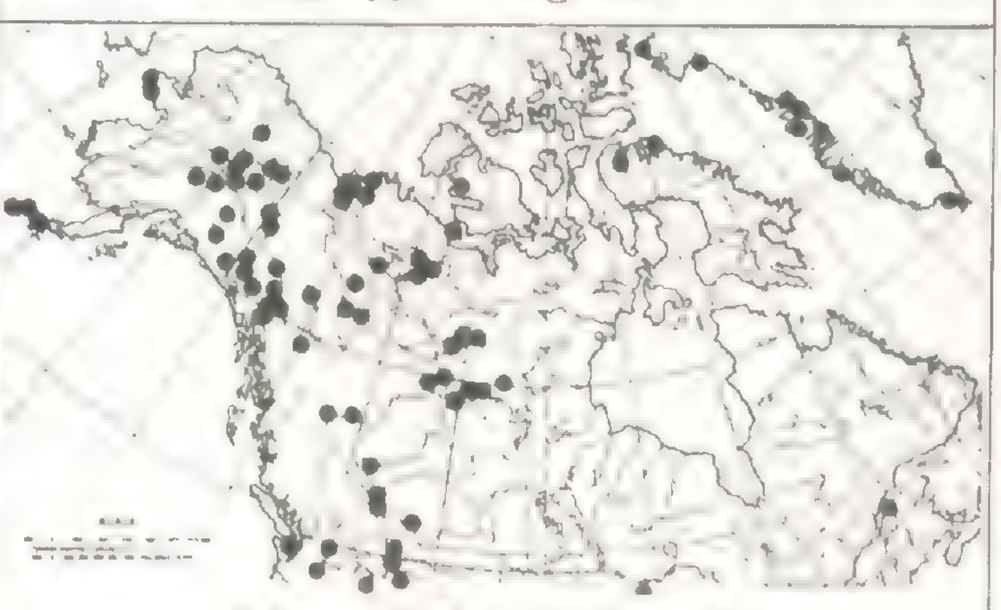
*Agropyron trachycaulum var. unilaterale*



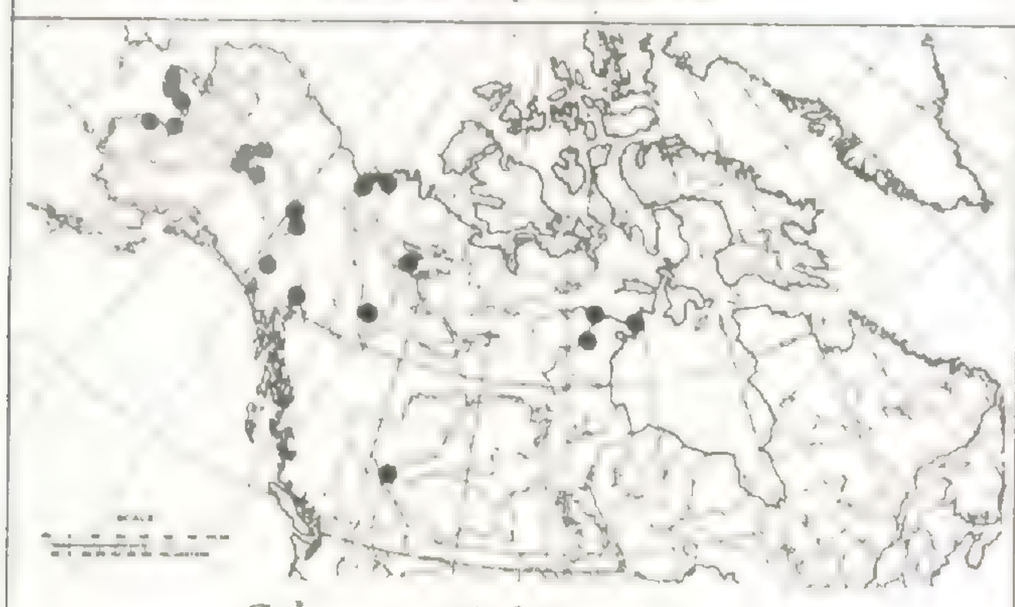
*Agropyron latiglume*



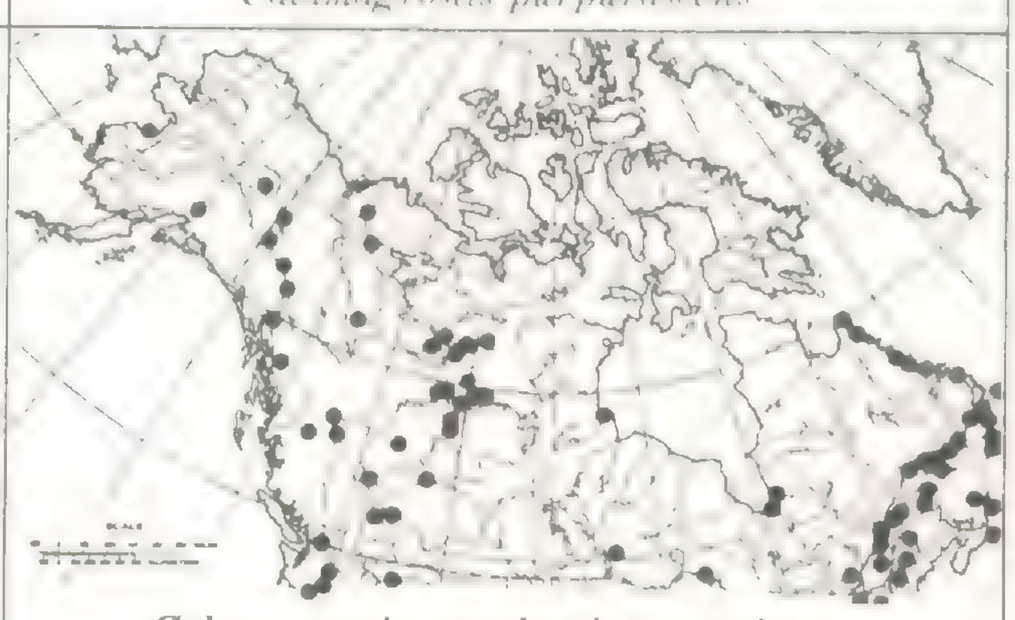
*Trisetum spicatum s.l.*



*Calamagrostis purpurascens*



*Calamagrostis lapponica s.l.*



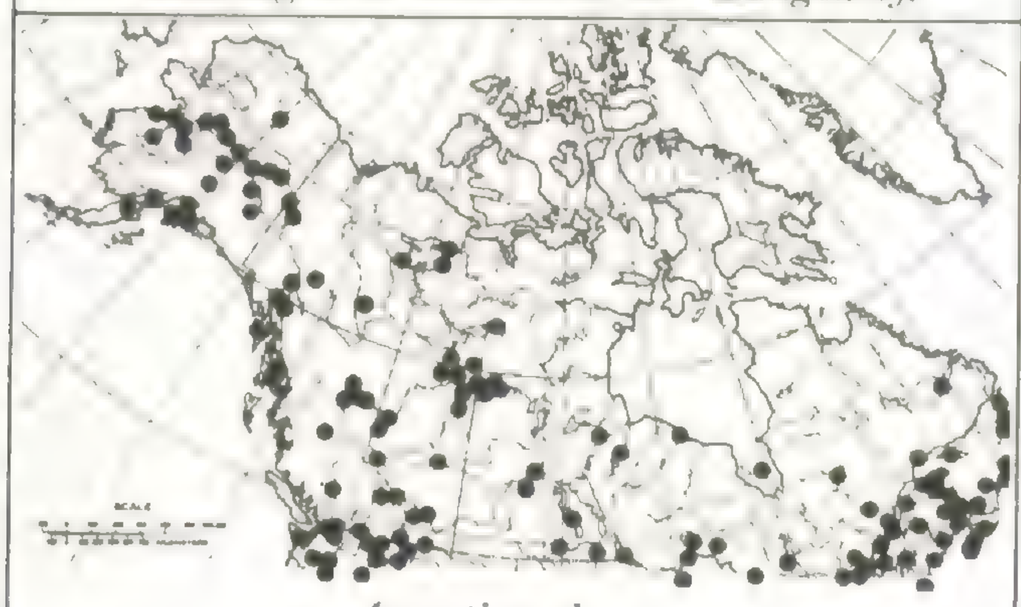
*Calamagrostis canadensis var. robusta*



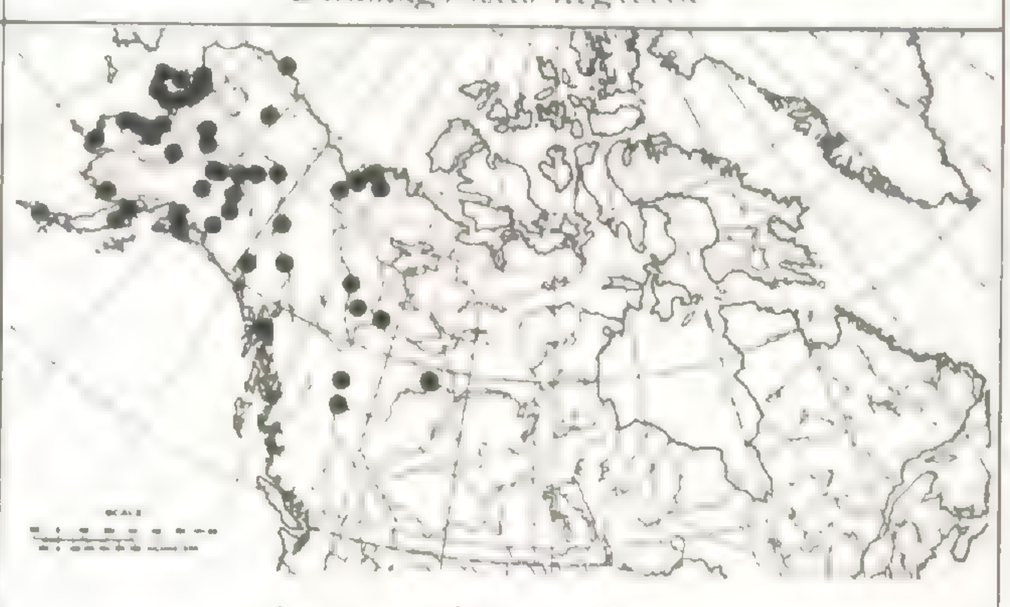
*Calamagrostis canadensis var. Langsdorfi*



*Calamagrostis neglecta*

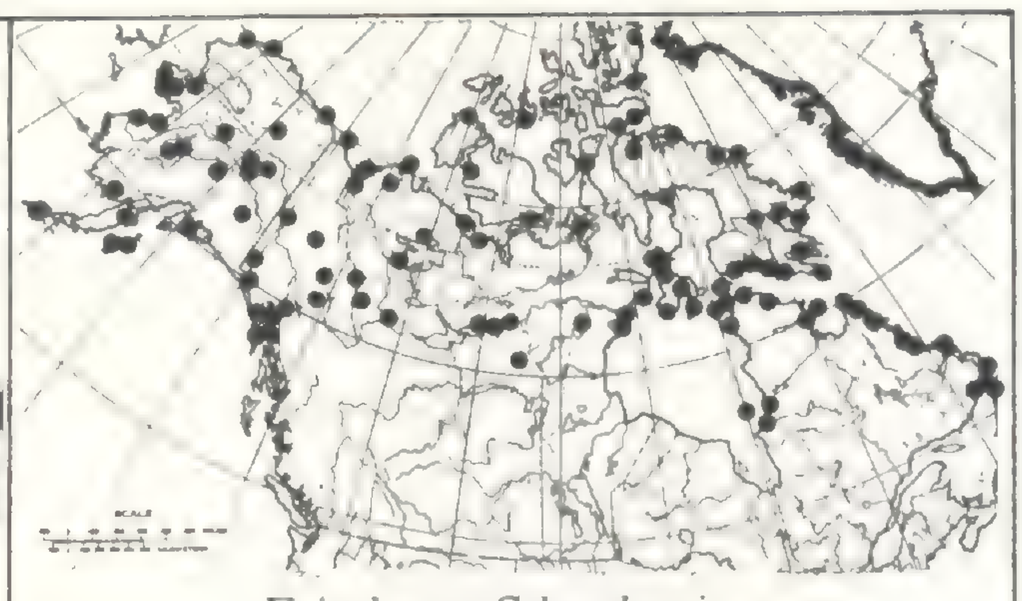


*Agrostis scabra*

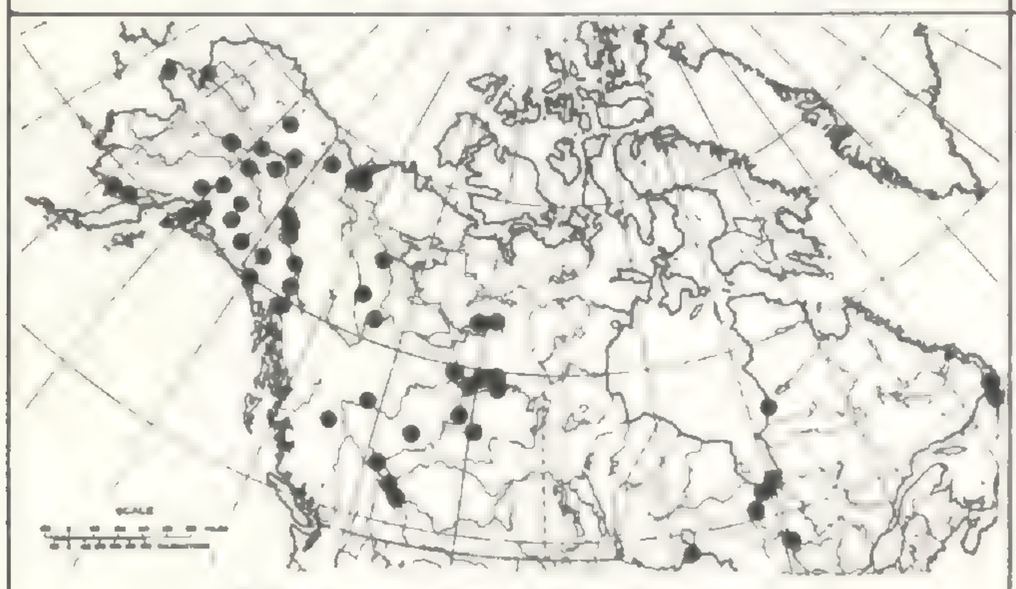


*Arctagrostis arundinacea*

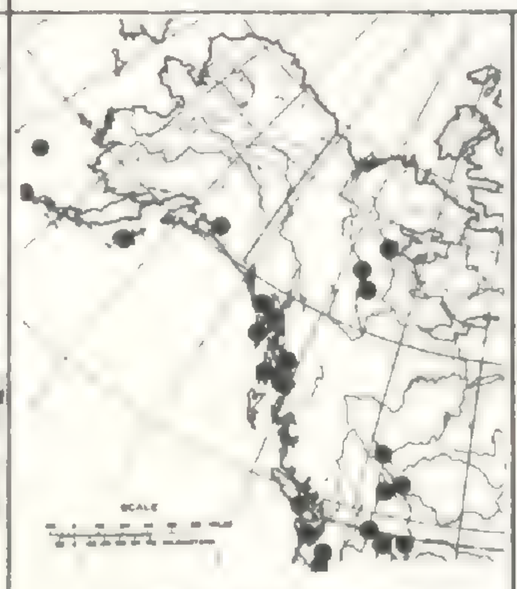
*Hierochloe alpina*



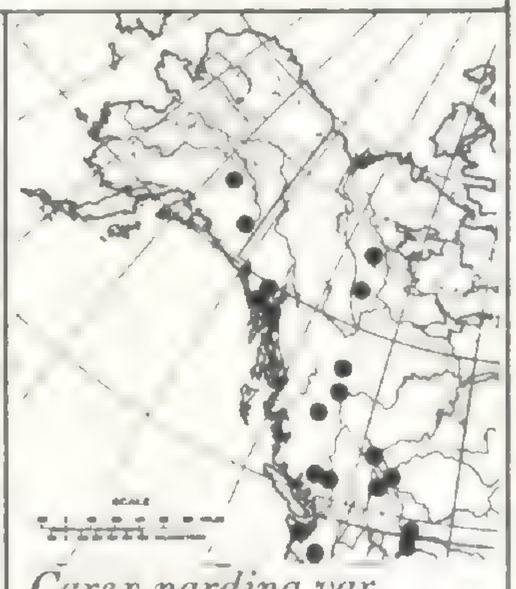
*Eriophorum Scheuchzeri*



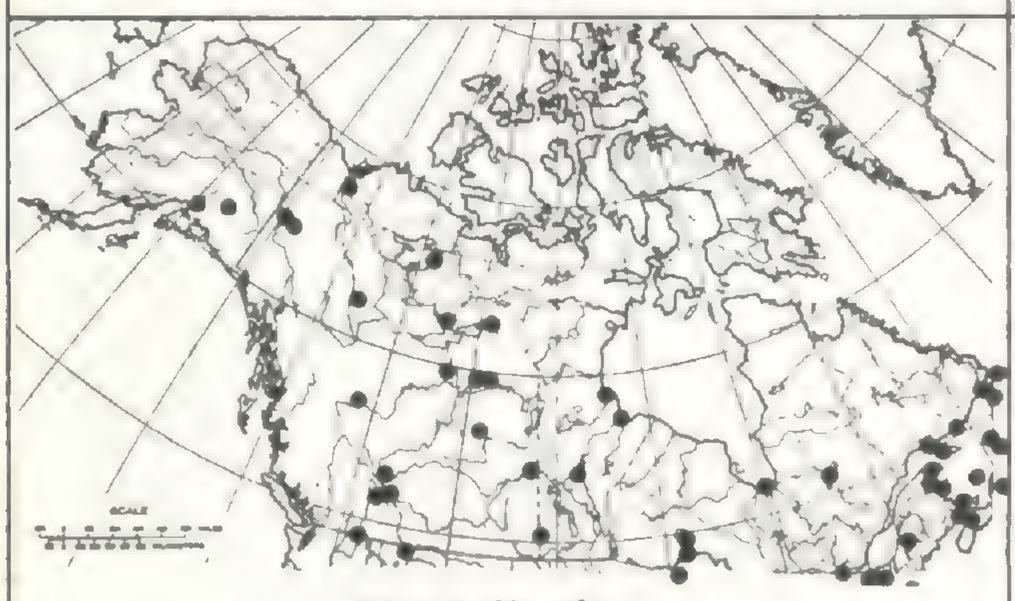
*Eriophorum brachyantherum*



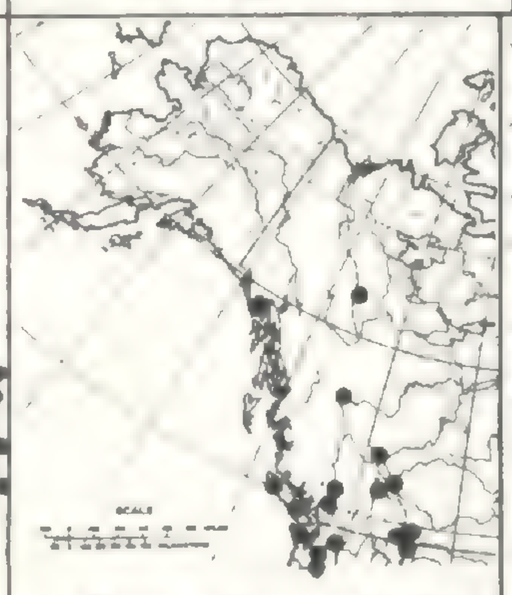
*Carex pyrenaica*



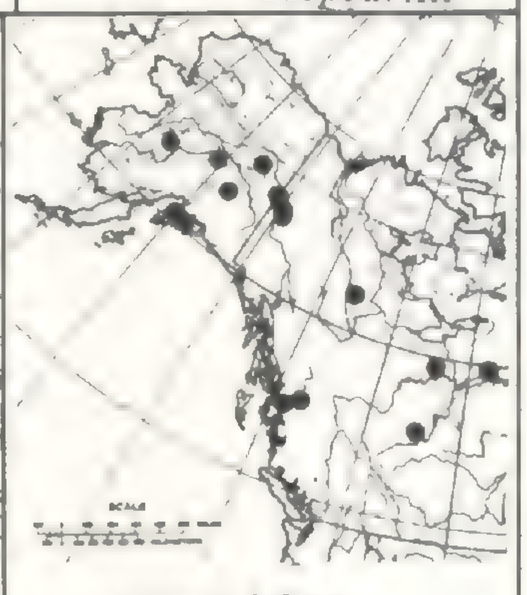
*Carex nardina var. Hepburnii*



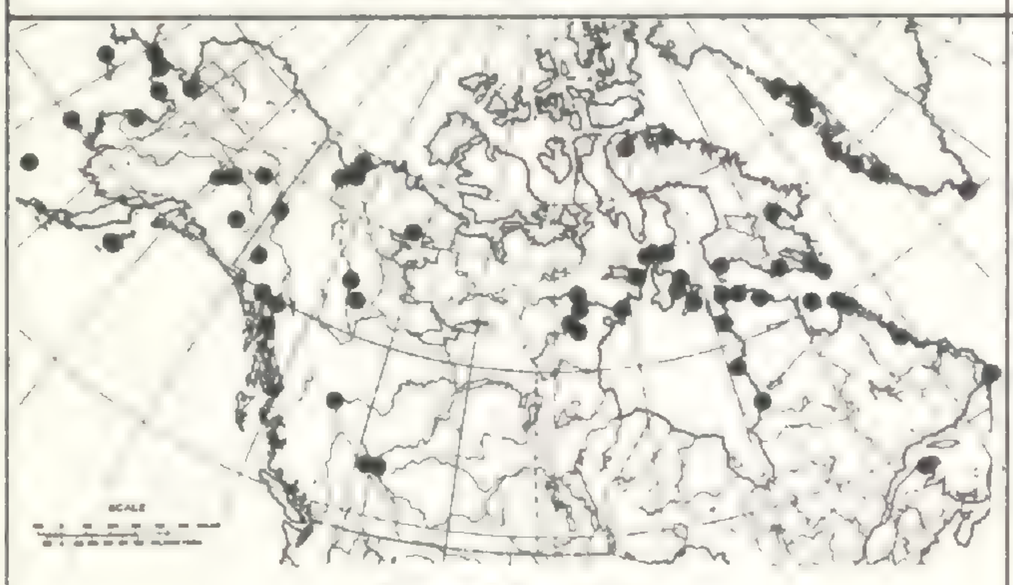
*Carex diandra*



*Carex phaeocephala*

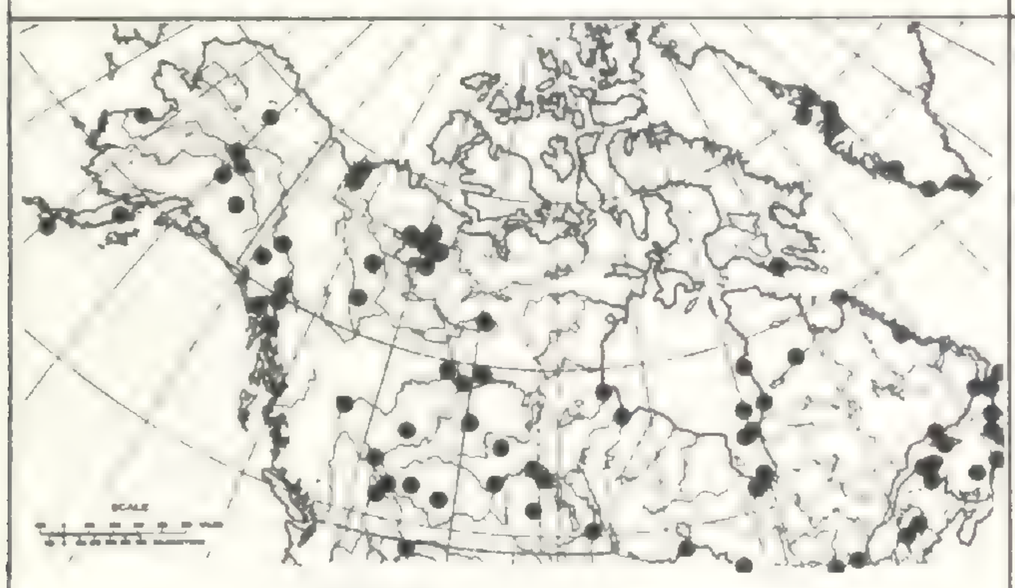


*Carex loliacea*

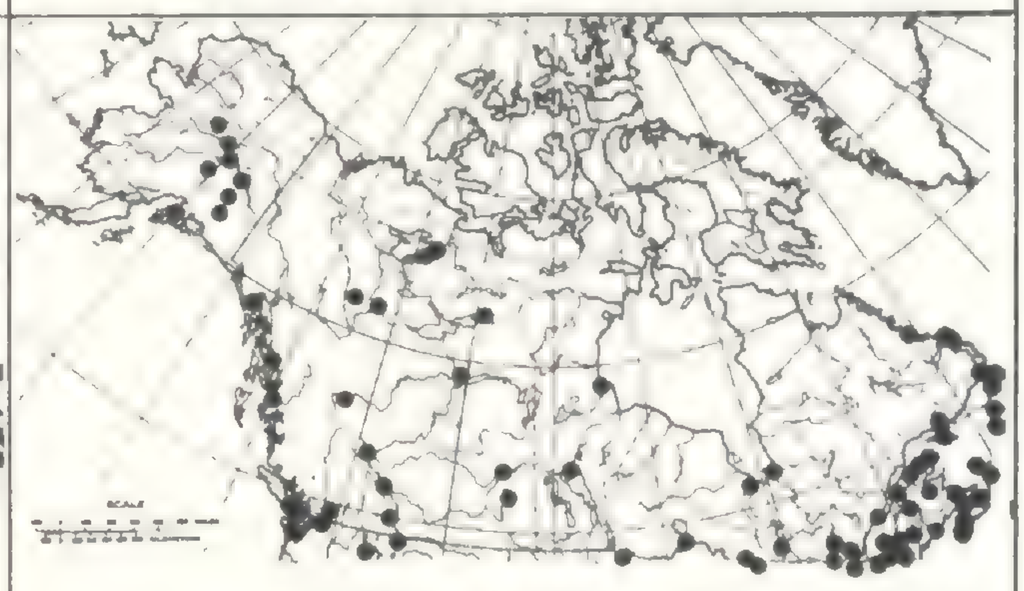


*Carex bipartita*

*Carex canescens*

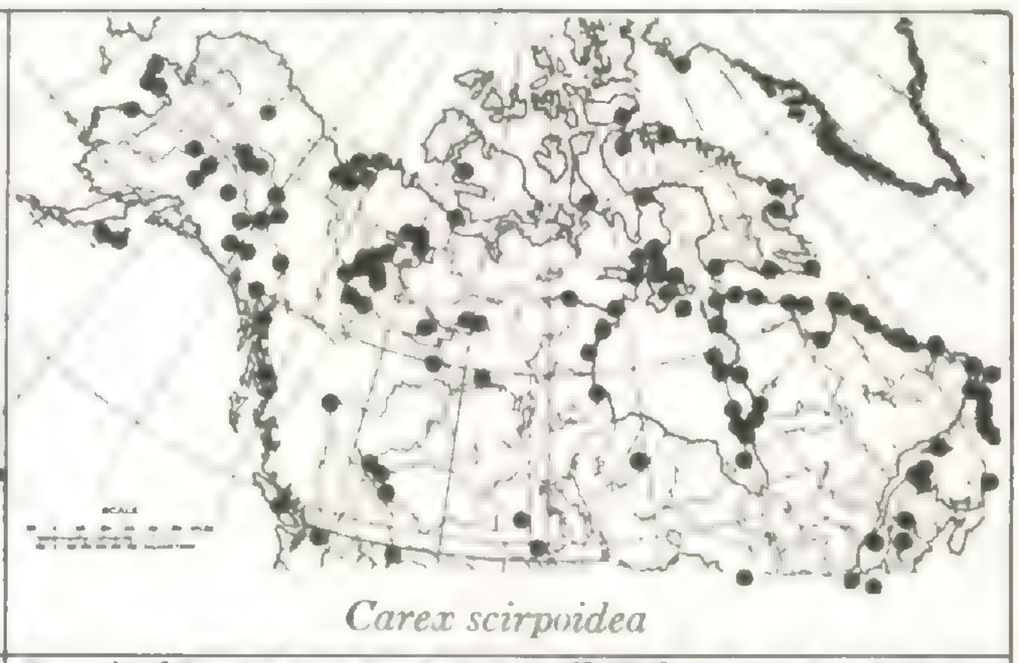


*Carex gynocrates*



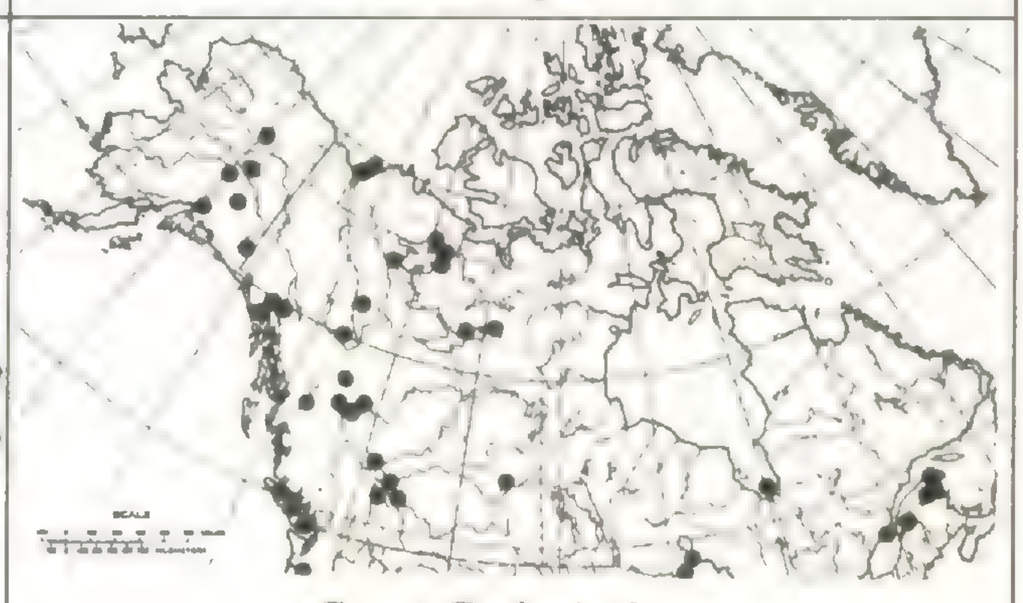
*Carex leptalea*

*Carex deflexa*

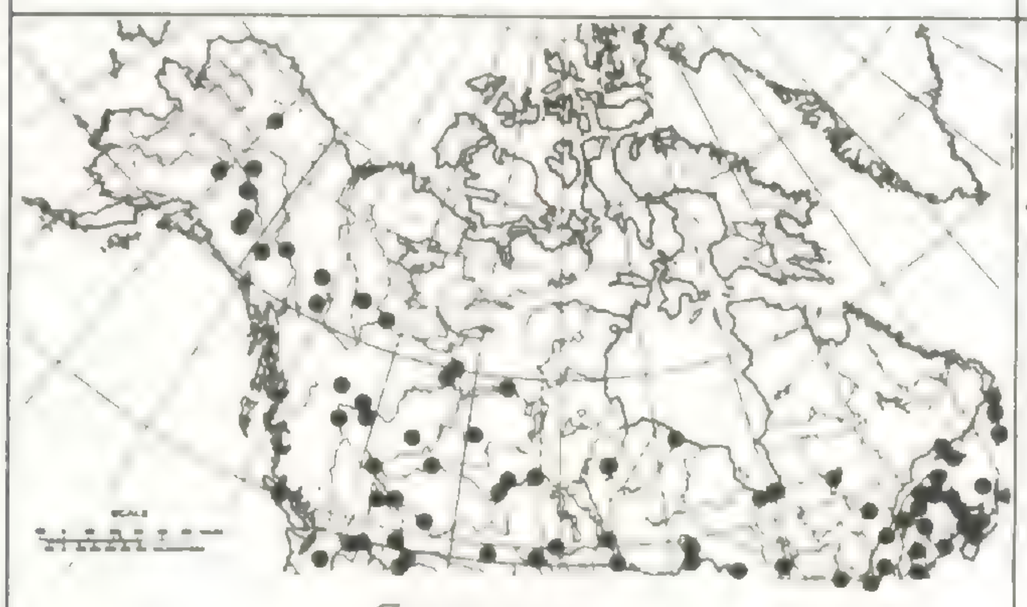


*Carex scirpoidea*

*Carex concinna*

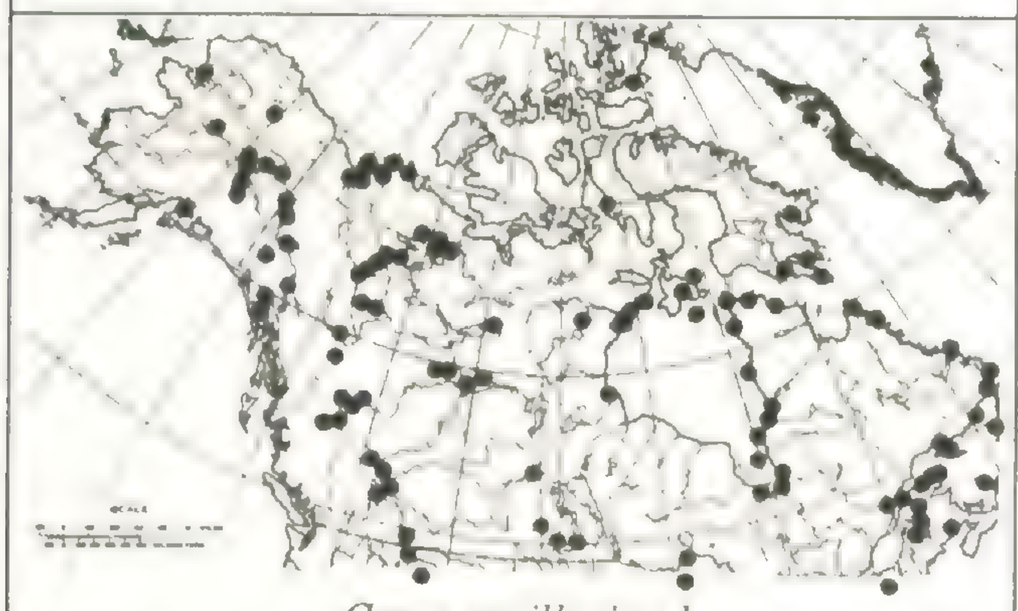


*Carex Garberi s.l.*

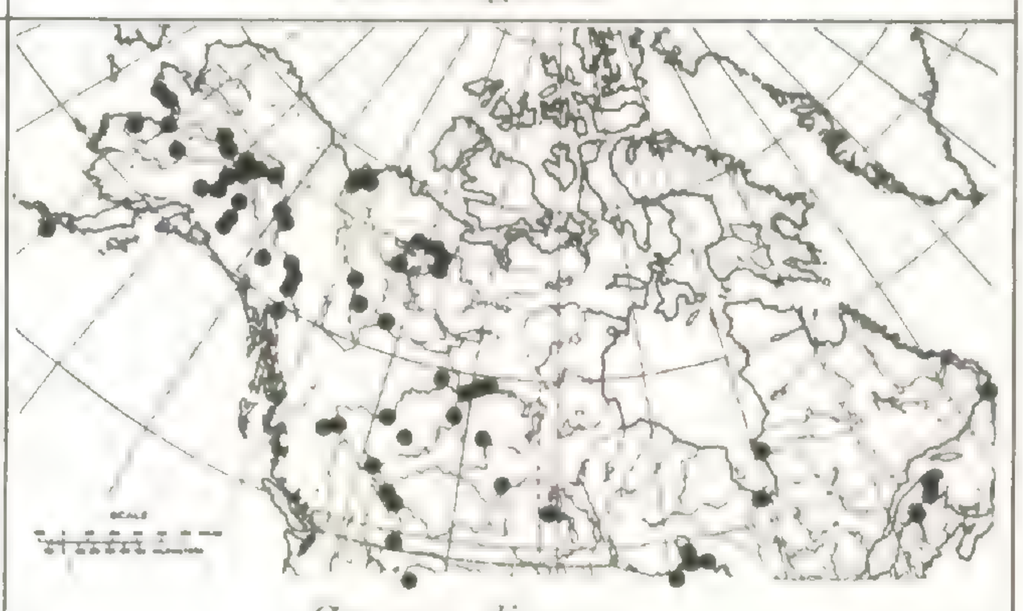


*Carex aurea*

*Carex vaginata*

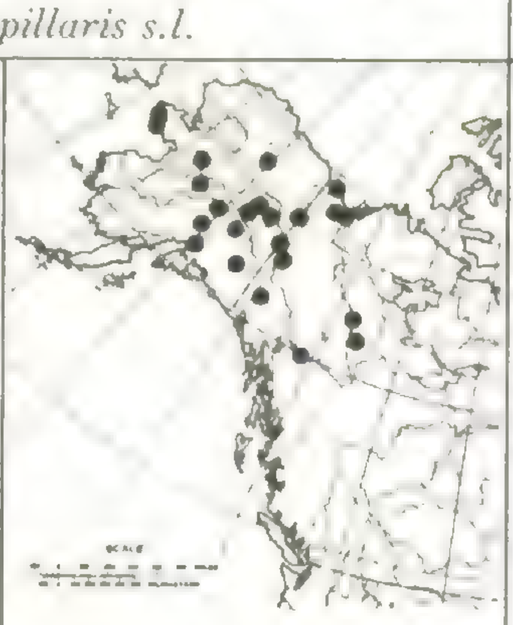


*Carex capillaris s.l.*



*Carex media*

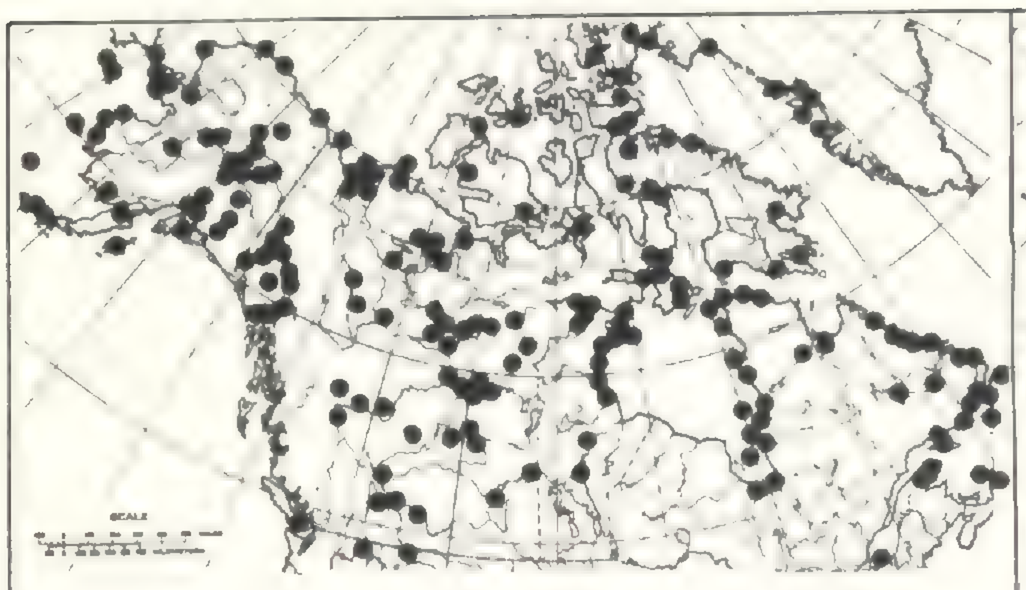
*Carex nesophila*



*Carex podocarpa*

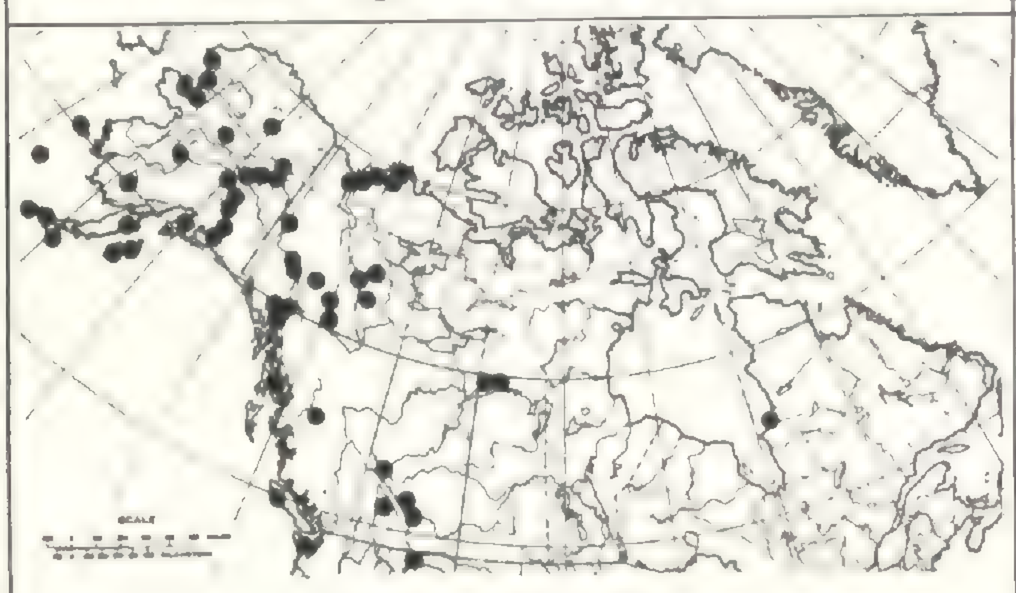
*Carex atrata ssp. atrosquama*

*Carex albo-nigra*

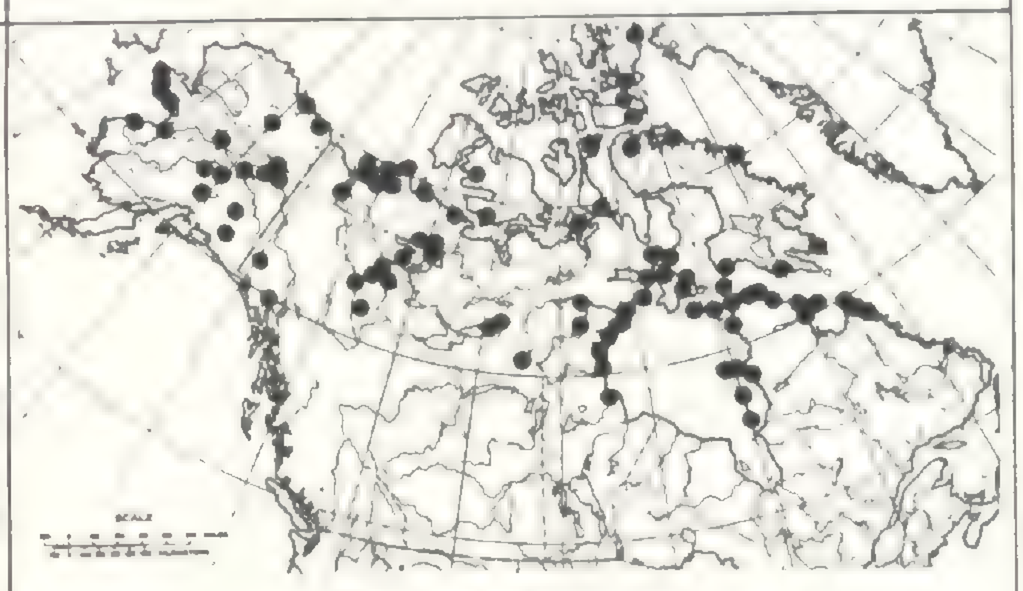


*Carex aquatilis, incl. var. stans*

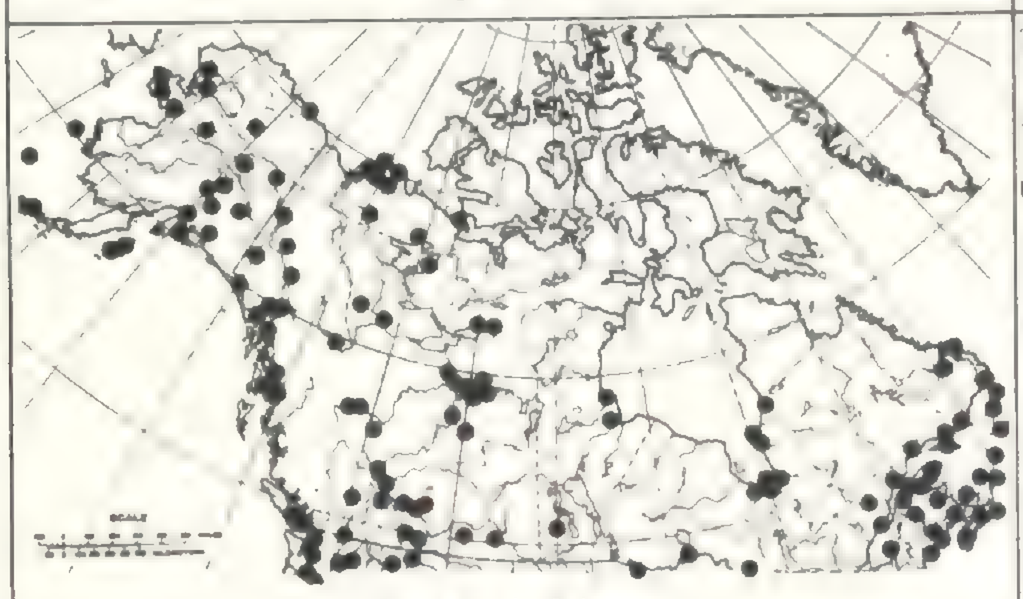
*Carex microglochin*



*Carex physocarpa*

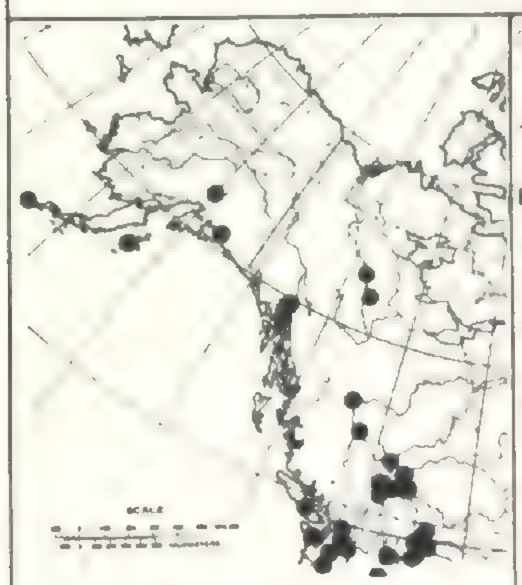


*Carex membranacea*

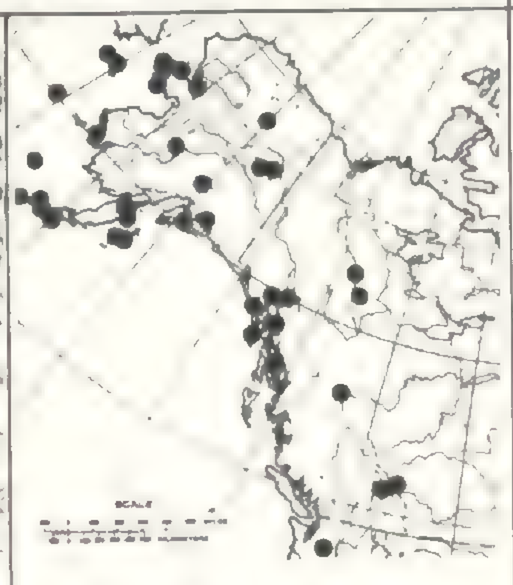


*Juncus balticus*

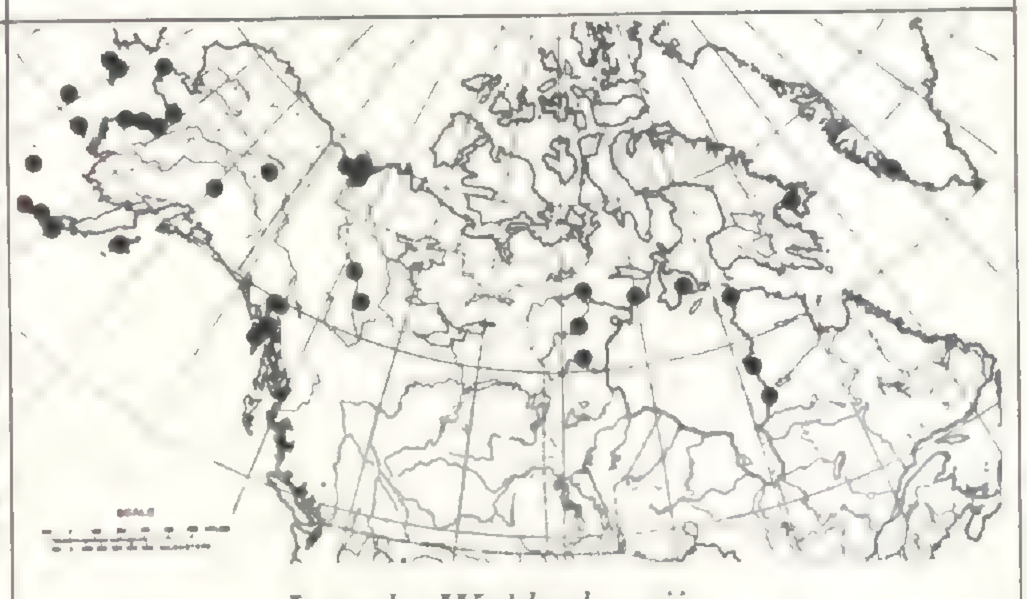
*Juncus castaneus*



*Juncus Drummondii*

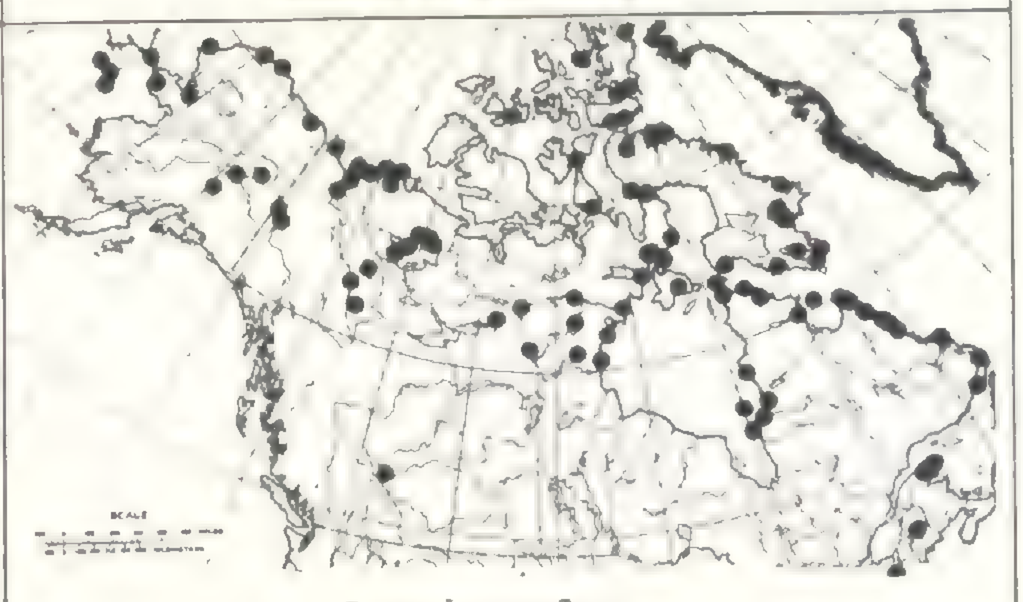


*Luzula arcuata*

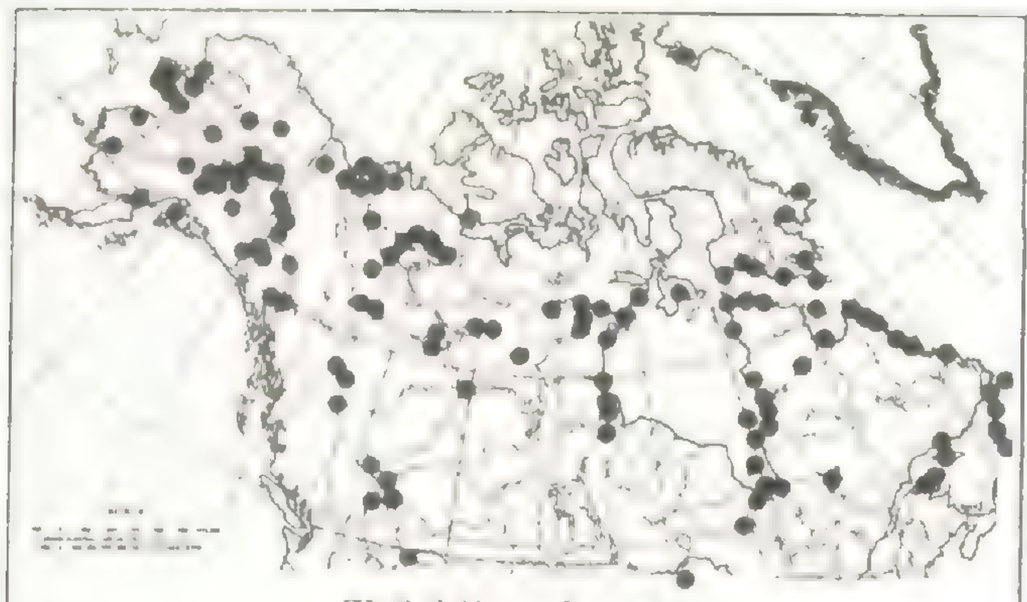


*Luzula Wahlenbergii*

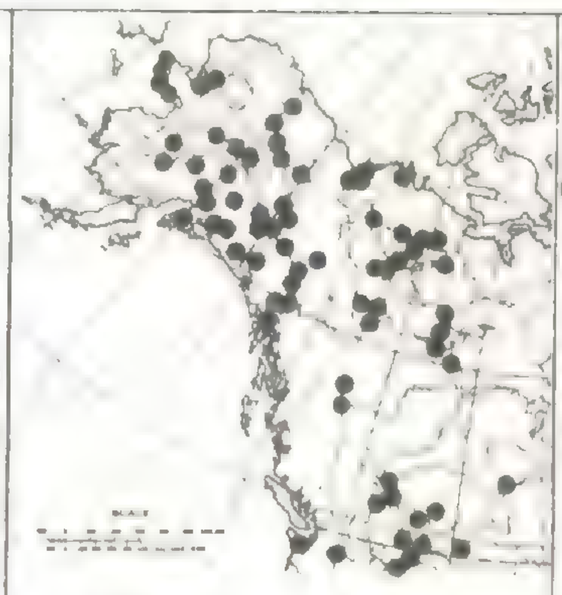
*Luzula spicata*



*Luzula confusa*

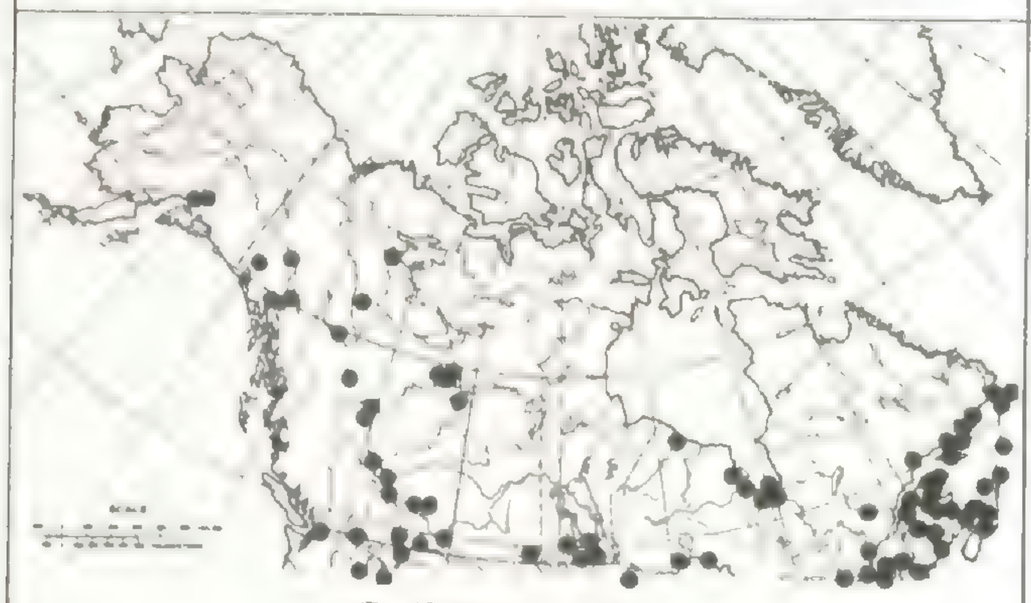


*Tofieldia palustris*



*Zygadenus elegans*

*Lloydia serotina*

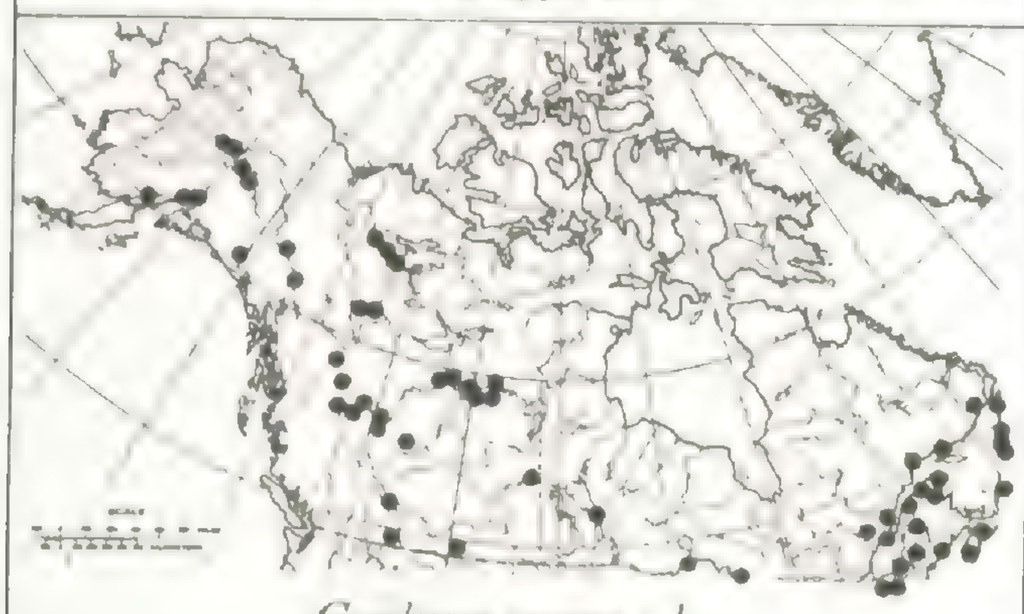


*Smilacina stellata*

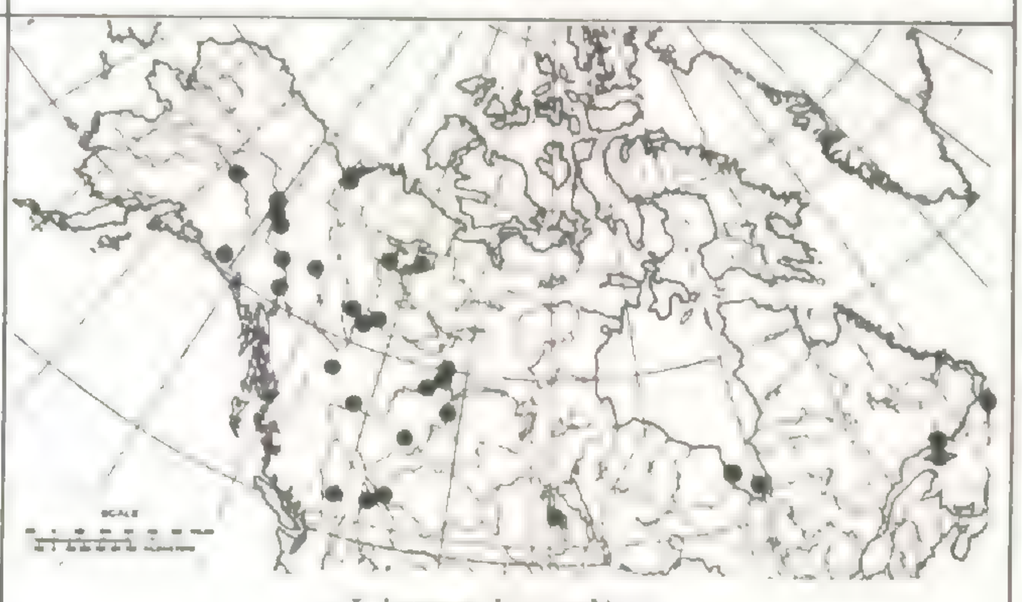
*Cypripedium passerinum*

*Habenaria hyperborea*

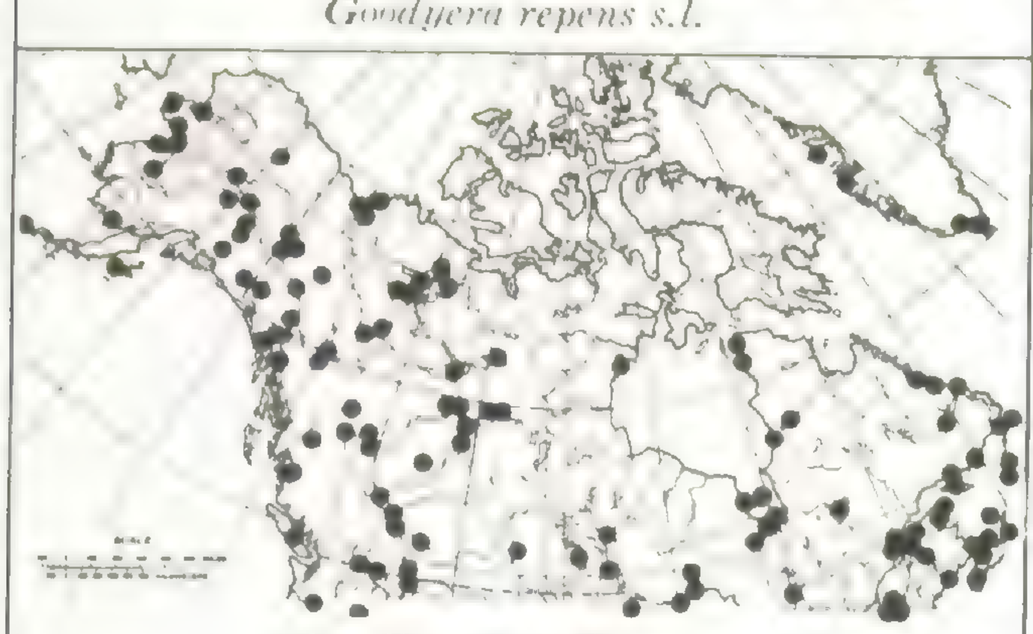
*Habenaria obtusata*



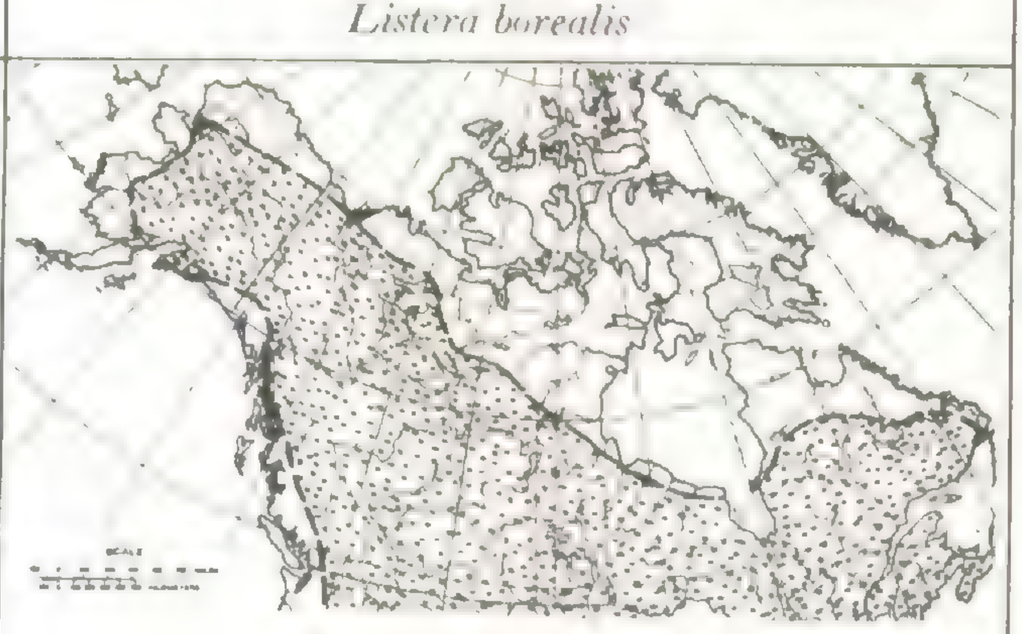
*Goodyera repens s.l.*



*Listera borealis*

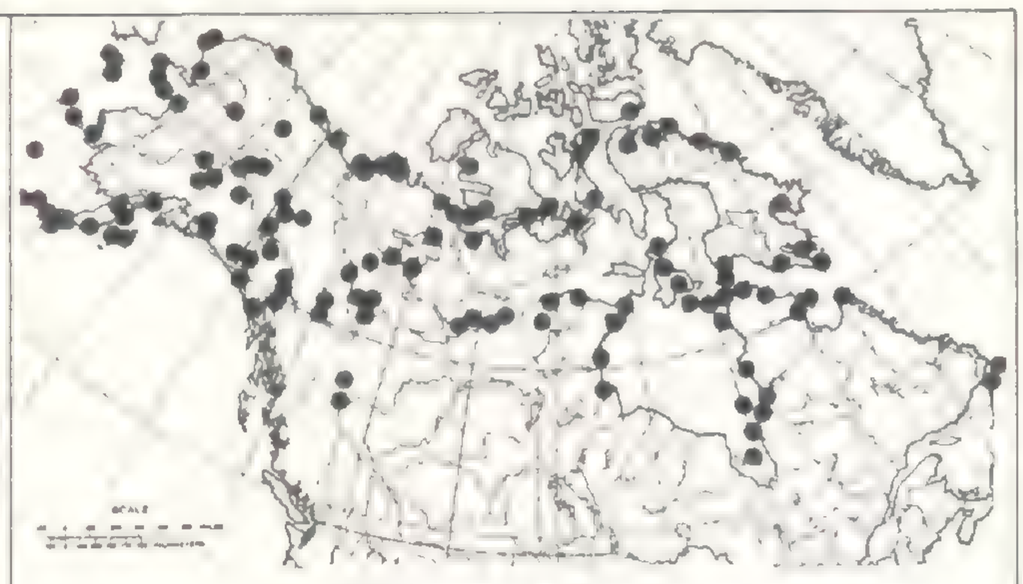


*Corallorrhiza trifida*

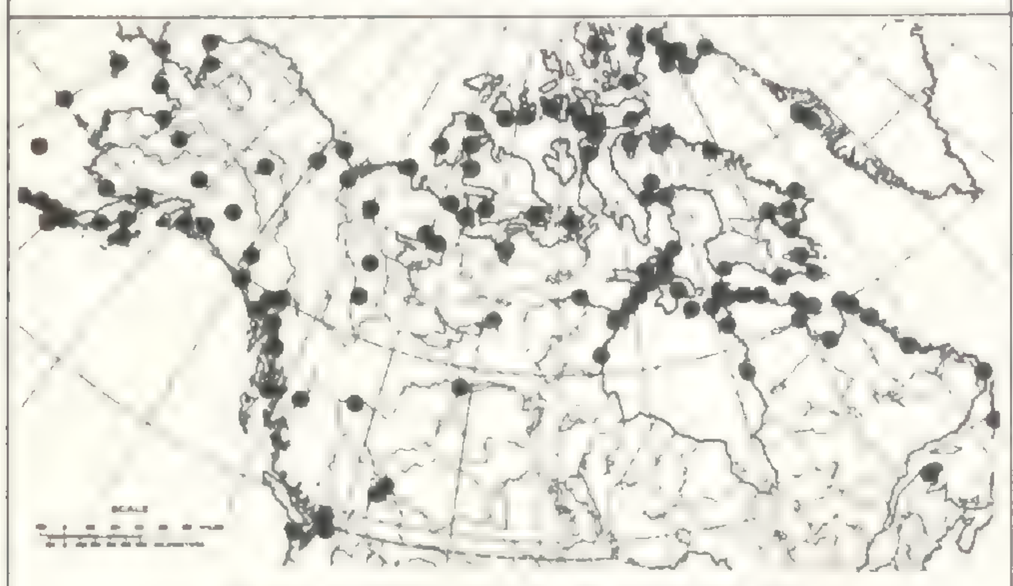


*Populus tremuloides*

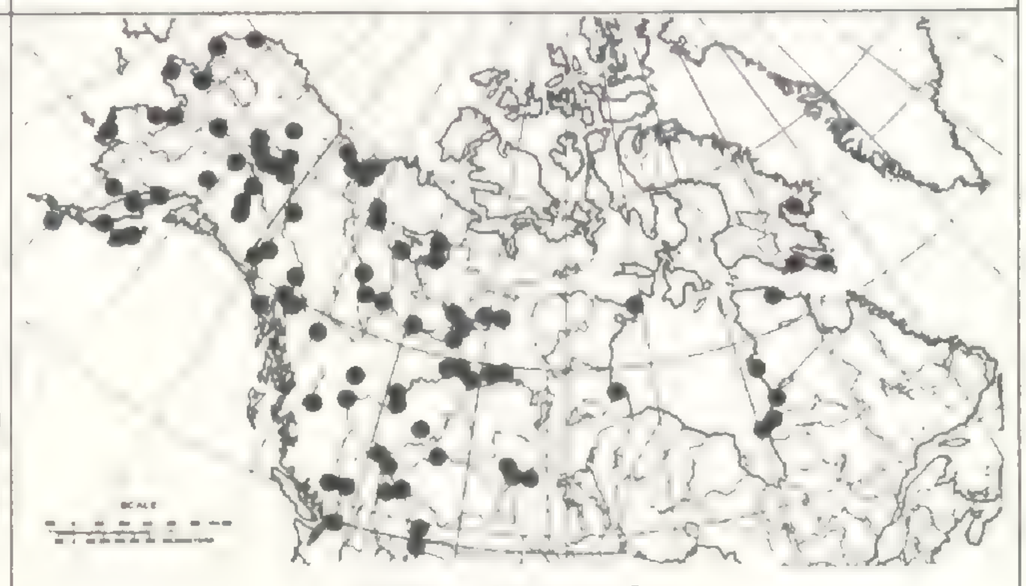
*Populus Tacamahacca*



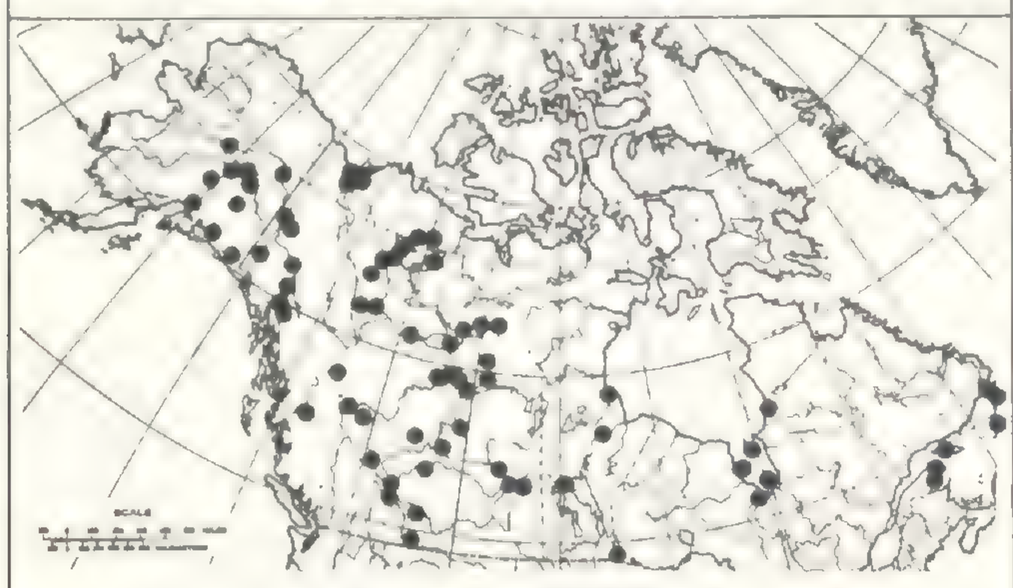
*Salix reticulata*



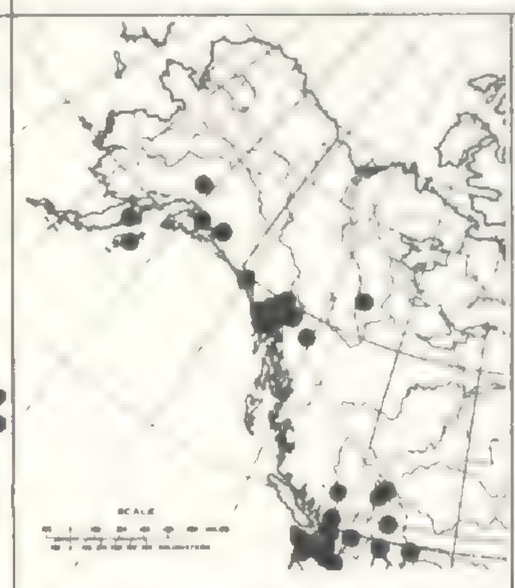
*Salix arctica, incl. S. crassijulis*



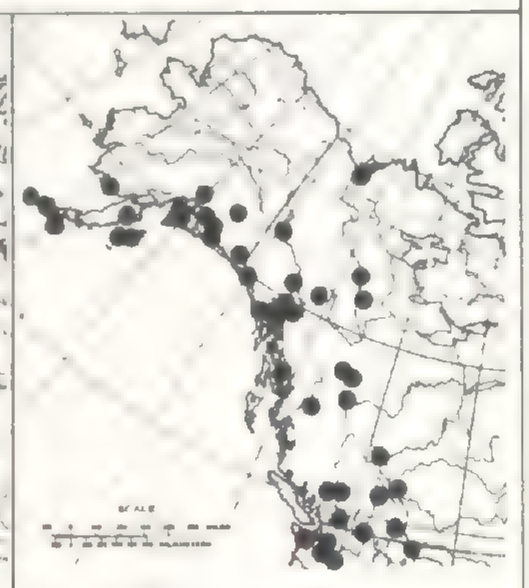
*Salix glauca s.l.*



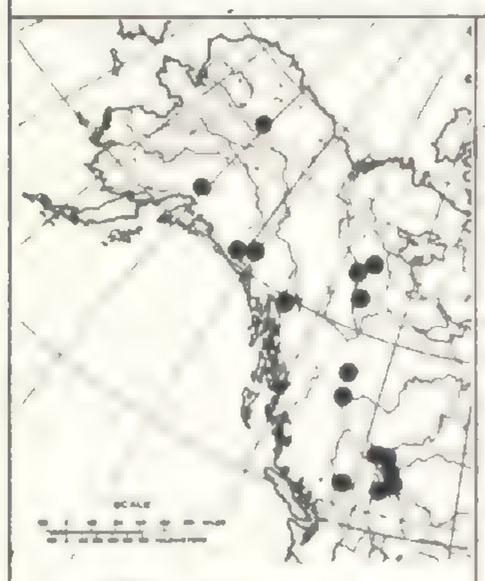
*Salix myrtillifolia*



*Salix commutata*



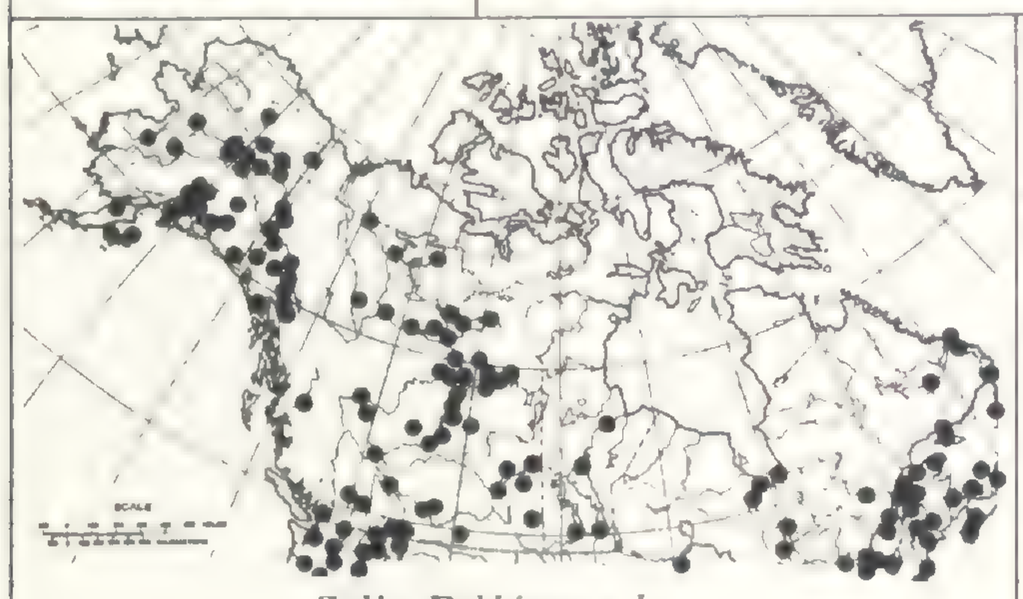
*Salix Barclayi*



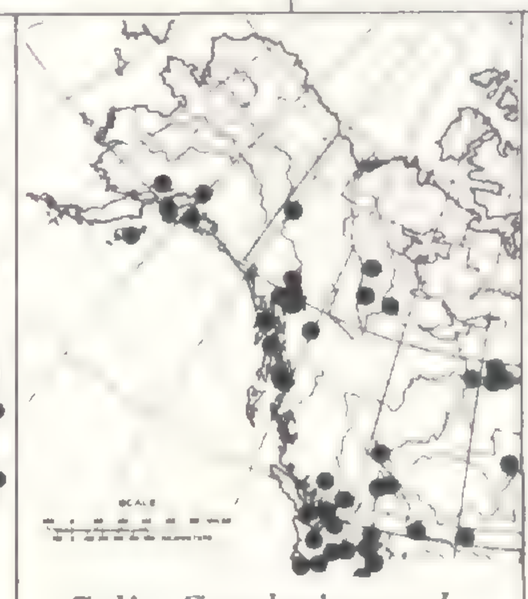
*Salix Barrattiana*

*Salix Richardsonii*

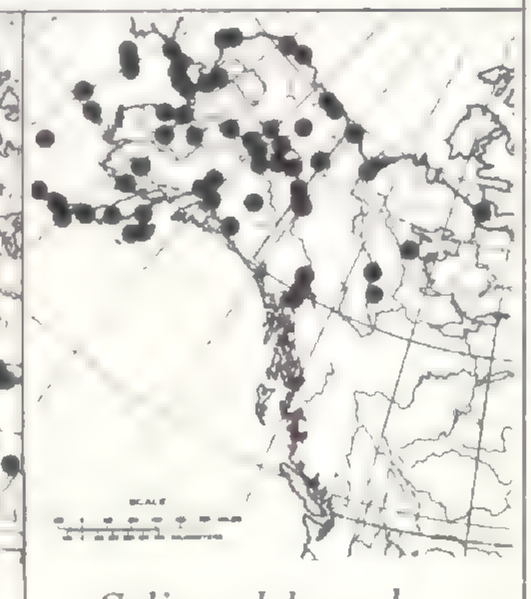
*Salix alaxensis s.l.*



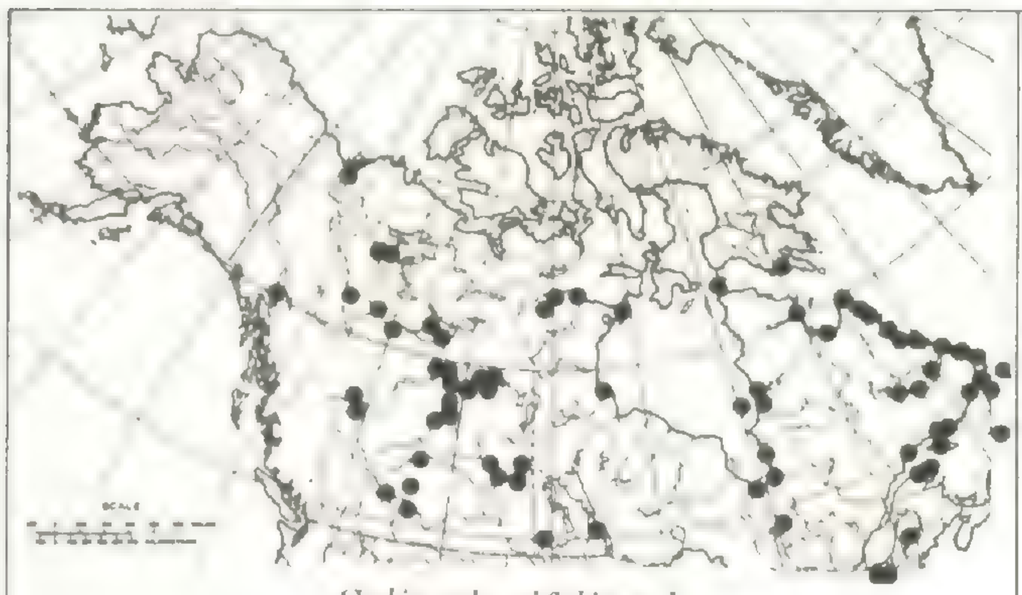
*Salix Bebbiana s.l.*



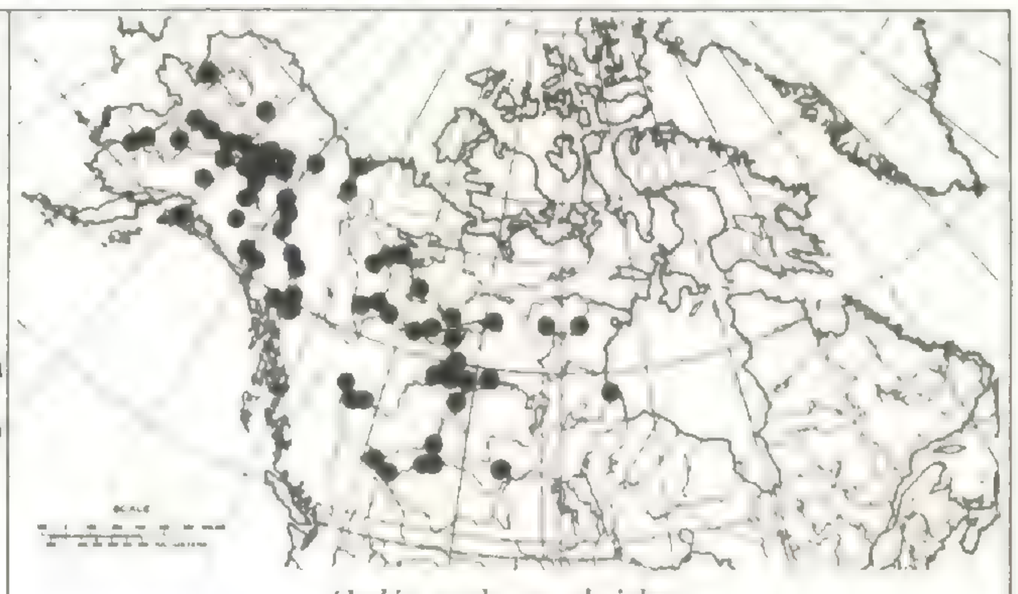
*Salix Scouleriana s.l.*



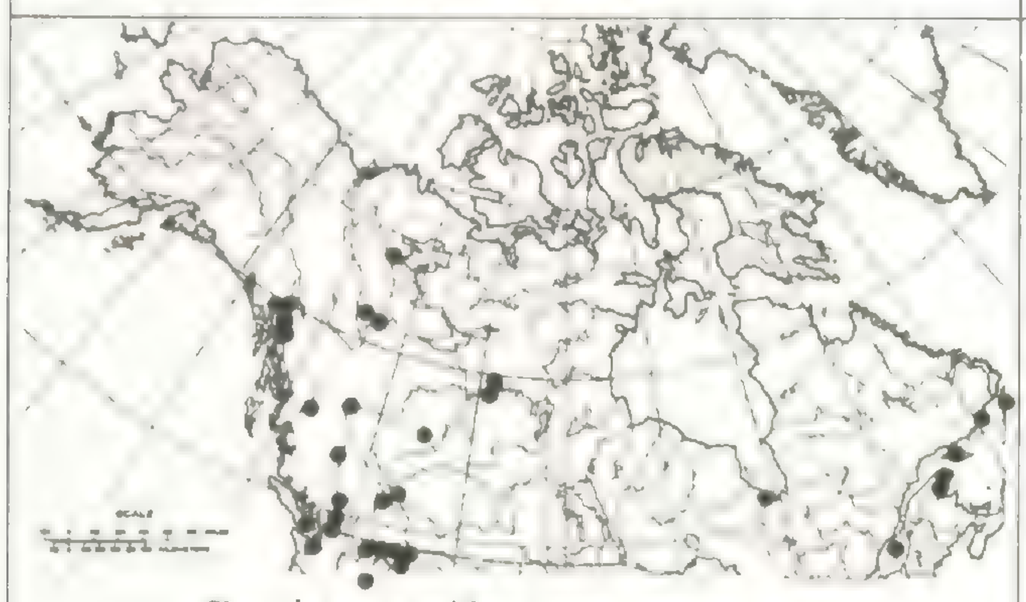
*Salix pulchra s.l.*



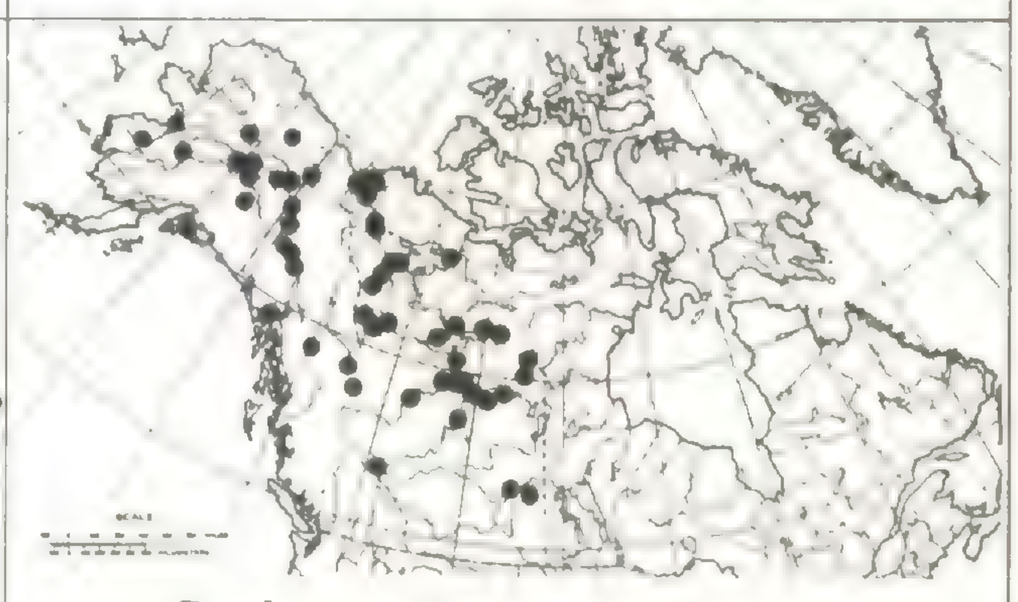
*Salix planifolia s.l.*



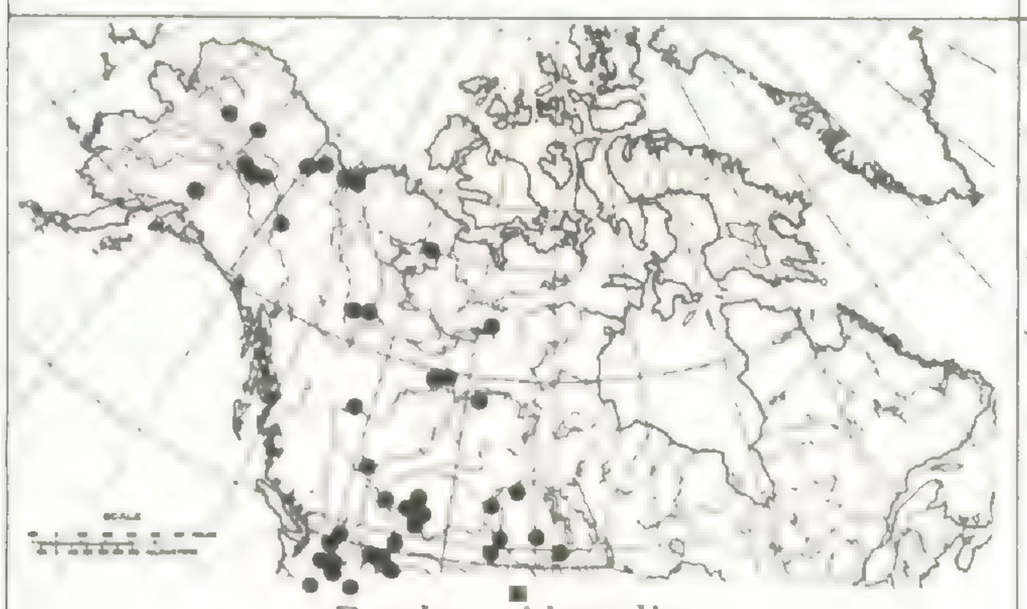
*Salix arbusculoides*



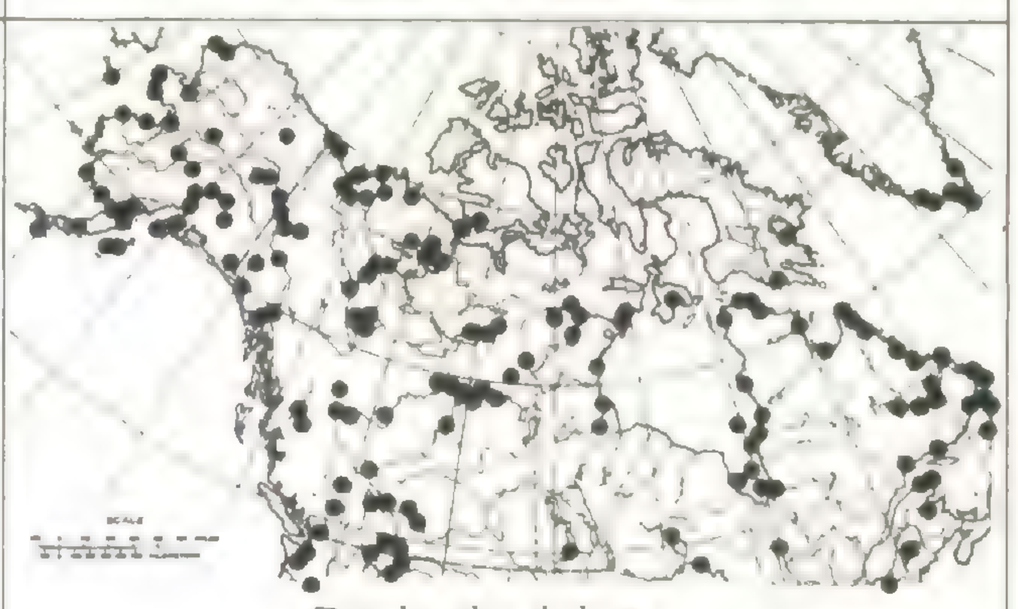
*Betula papyrifera var. commutata*



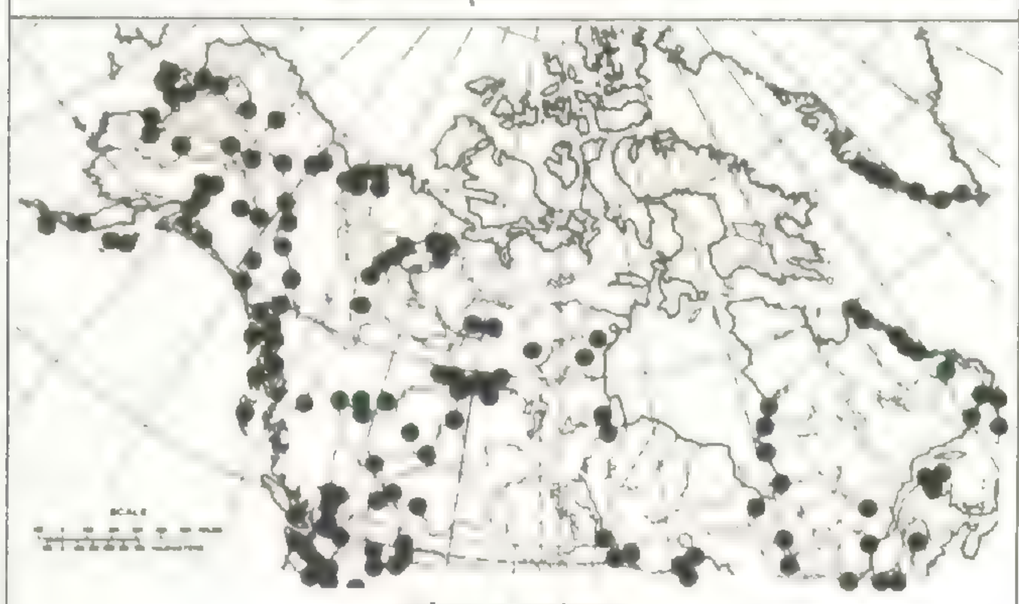
*Betula papyrifera var. humilis*



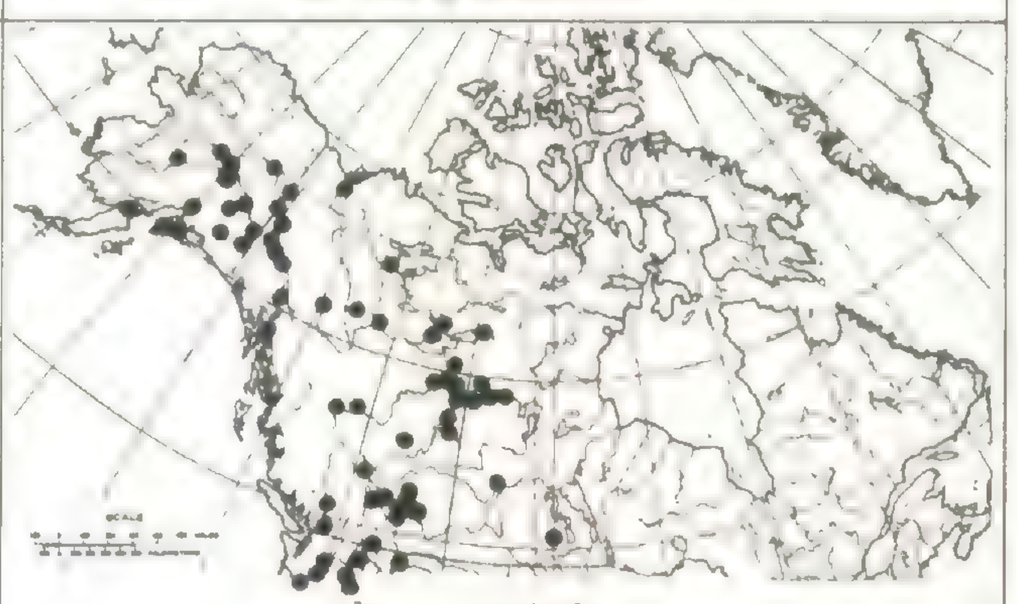
*Betula occidentalis*



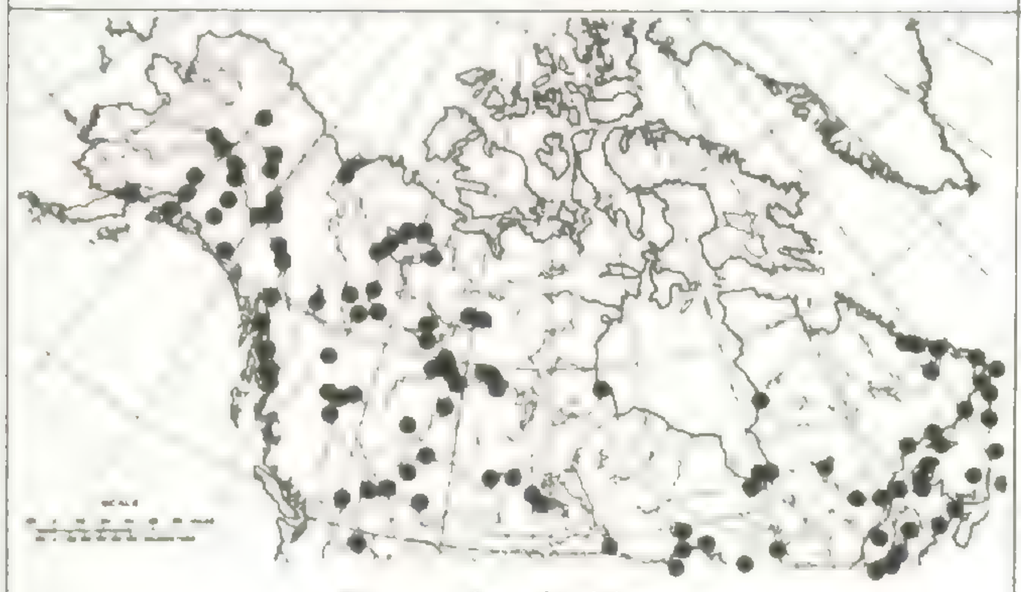
*Betula glandulosa*



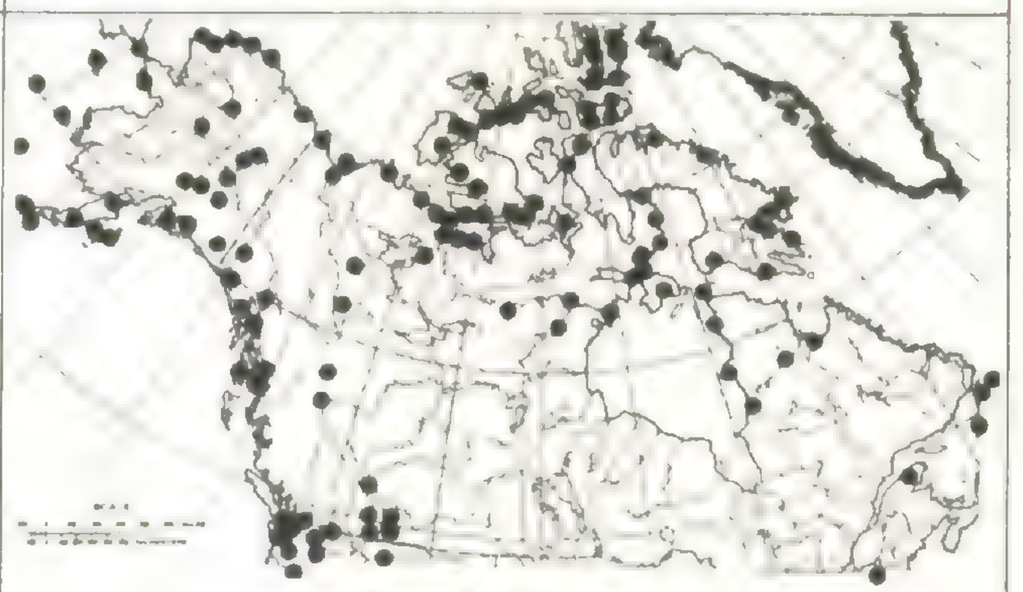
*Alnus crispa*



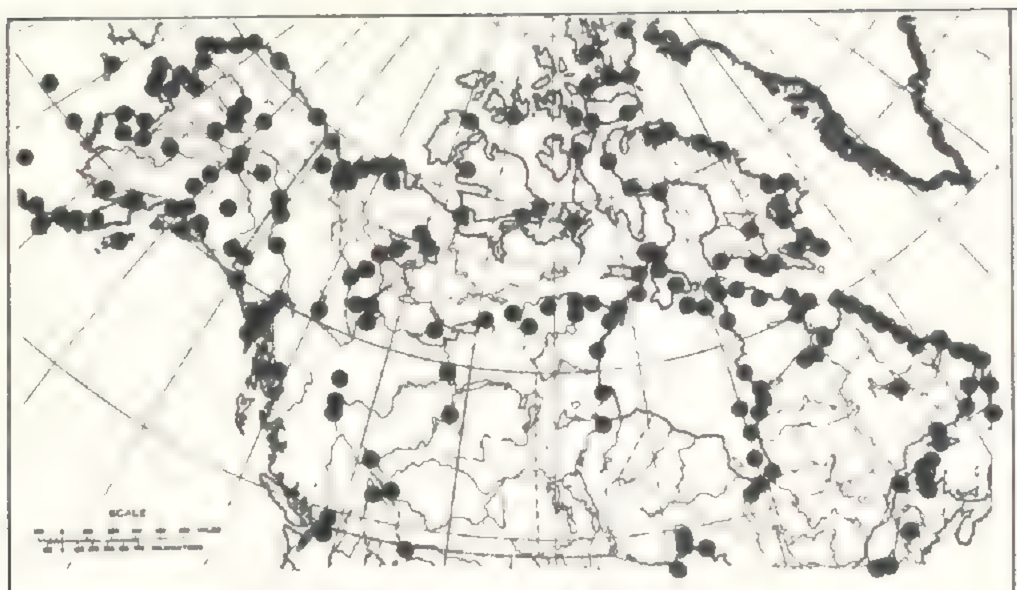
*Alnus tenuifolia*



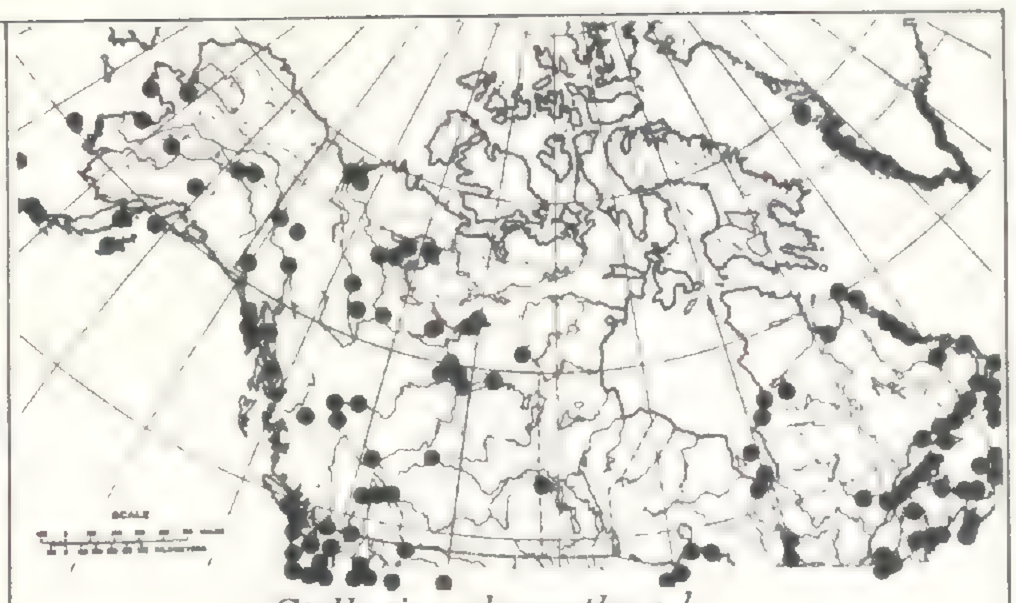
*Geocaulon lividum*



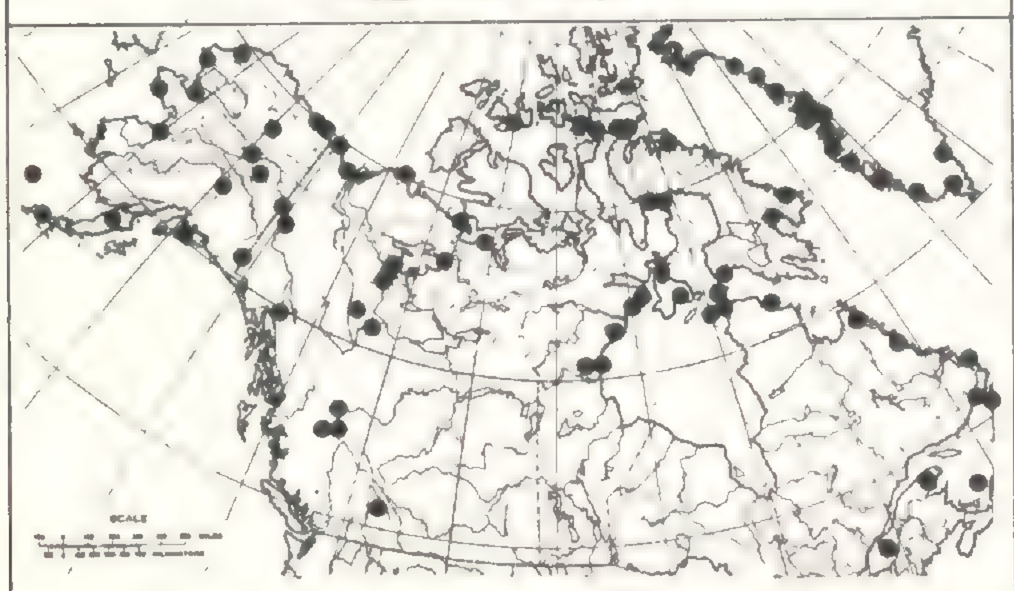
*Oxyria digyna*



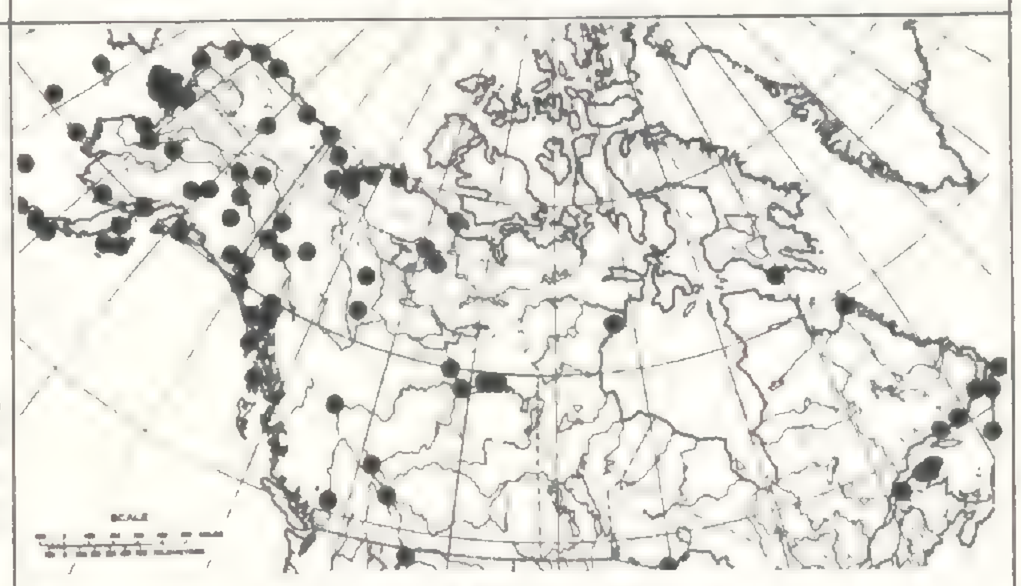
*Polygonum viviparum*



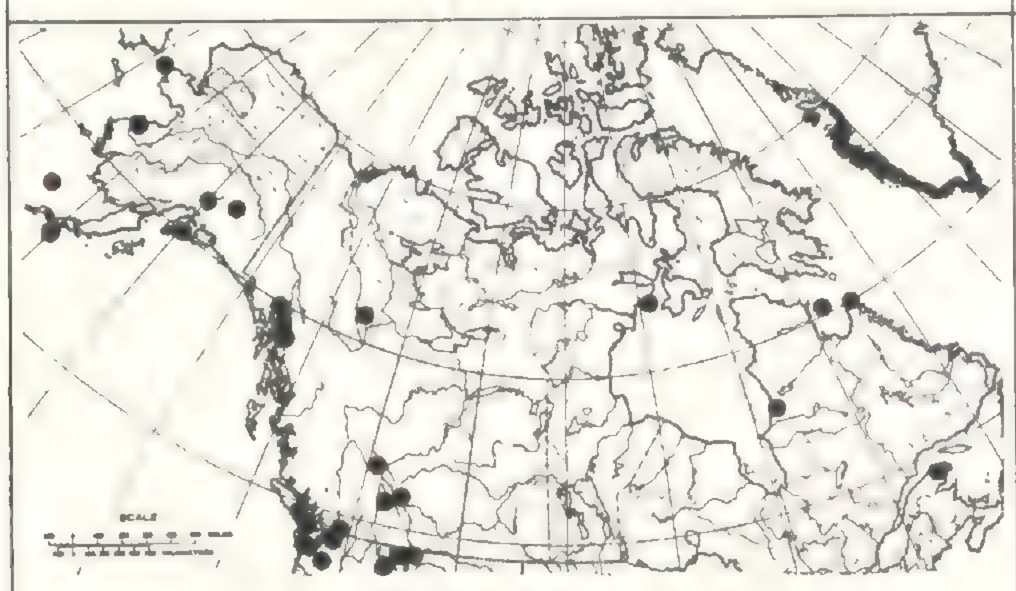
*Stellaria calycantha s.l.*



*Stellaria longipes var. Edwardsii*

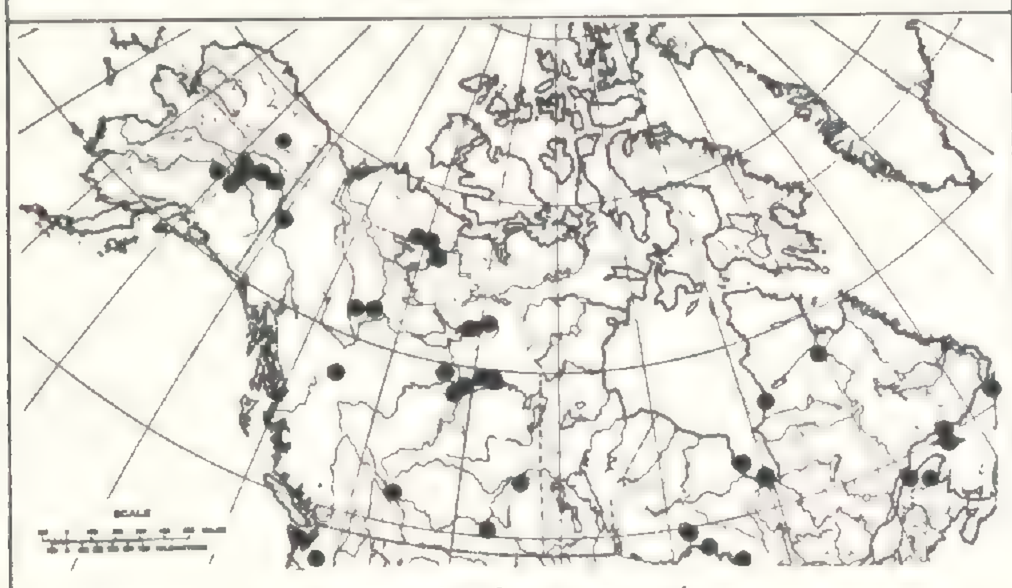


*Cerastium Beeringianum*



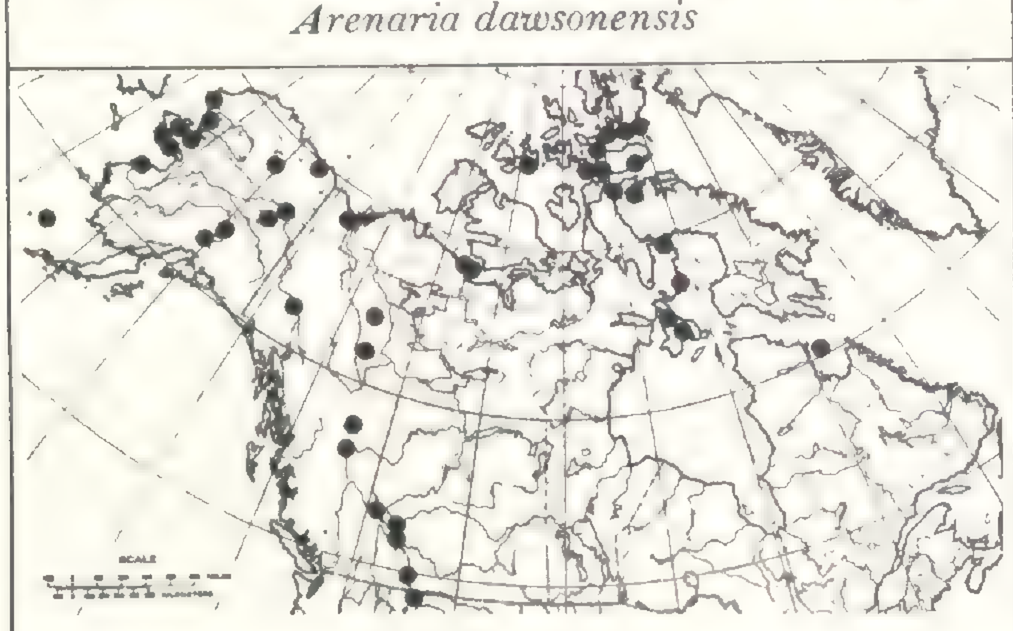
*Sagina Linnaei*

*Arenaria lateriflora*



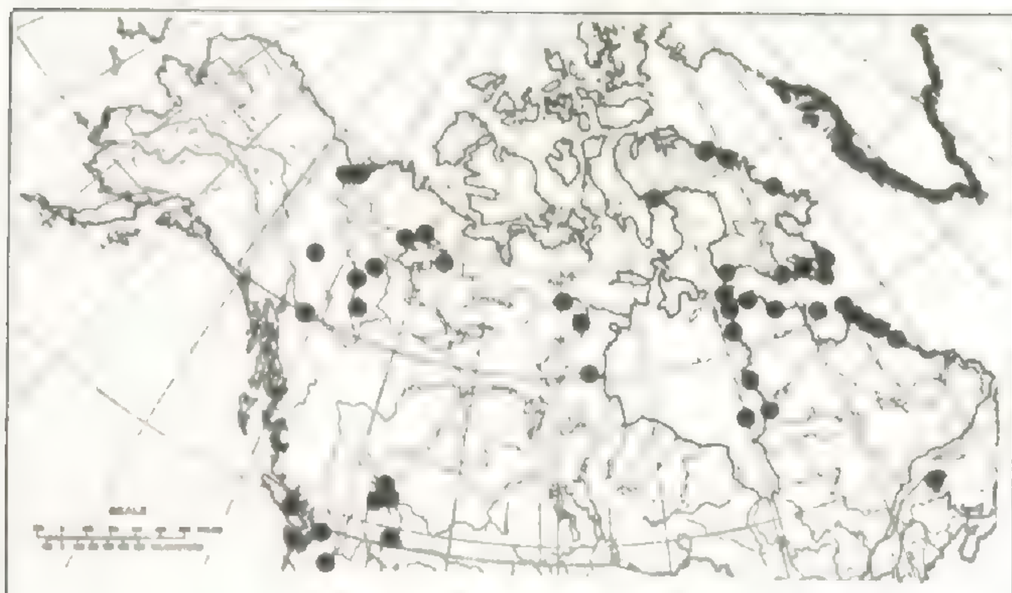
*Arenaria dawsonensis*

*Arenaria verna var. pubescens*

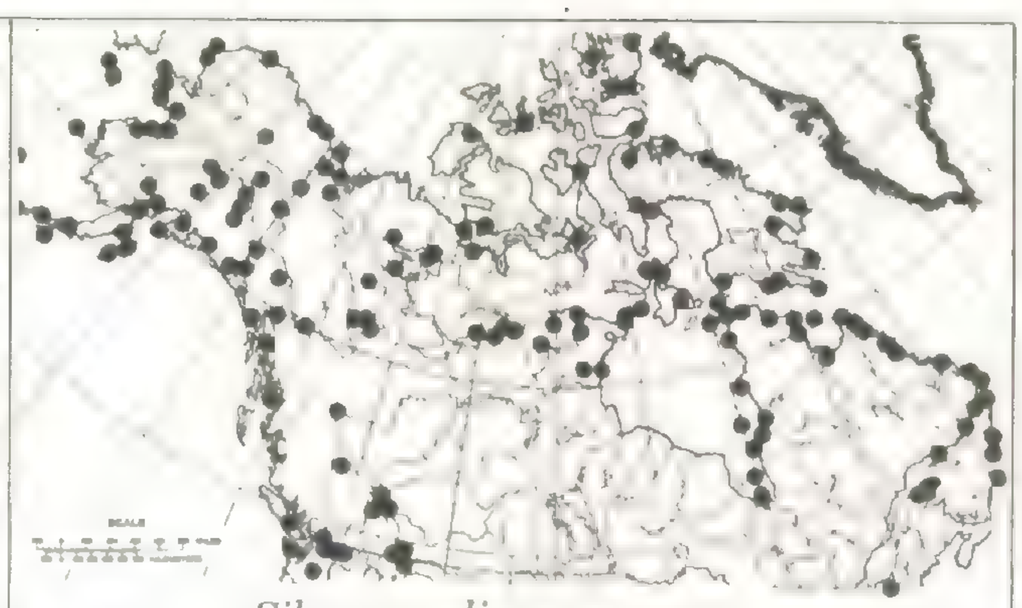


*Arenaria Rossii*

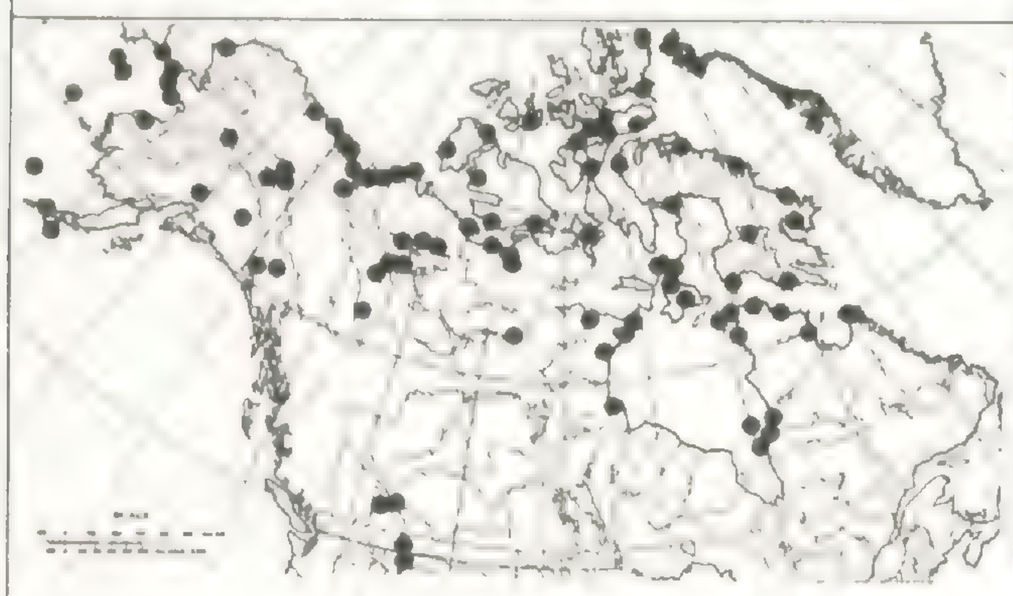
*Arenaria humifusa*



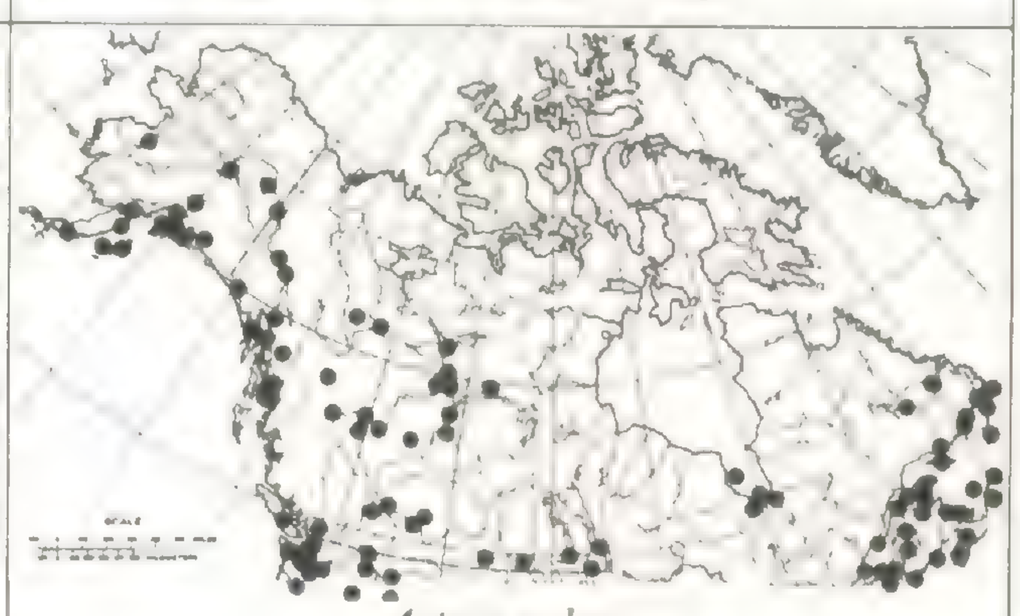
*Arenaria sajanensis*



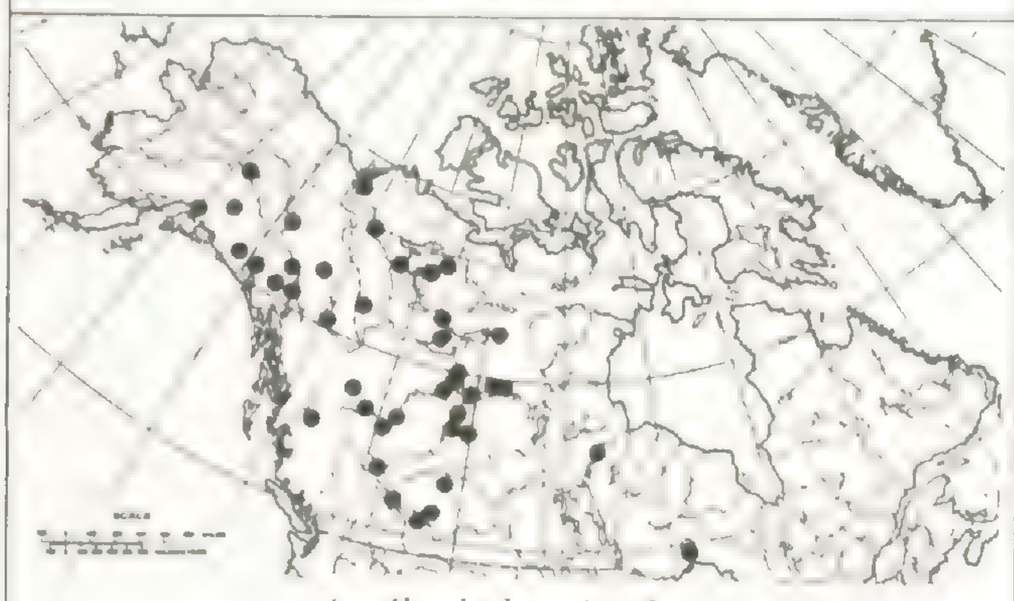
*Silene acaulis var. exscapa*



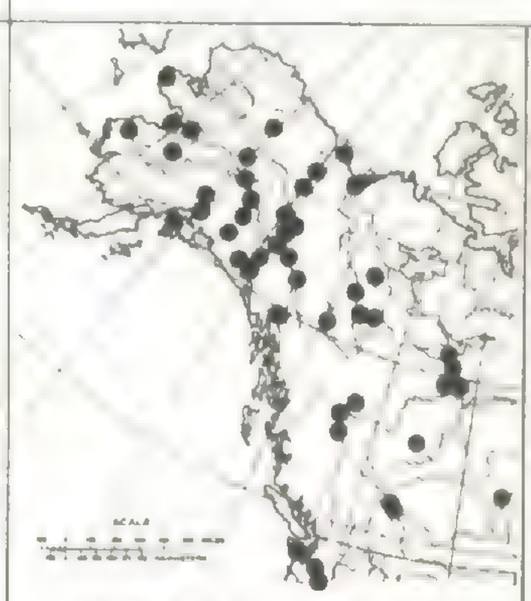
*Lychnis apetala*



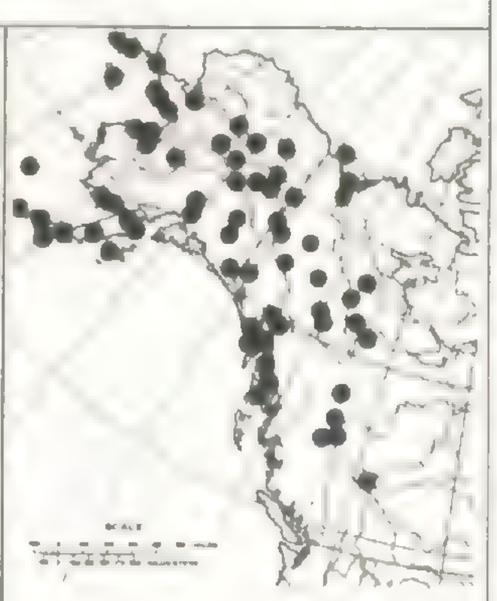
*Actaea rubra*



*Aquilegia brevistyla*

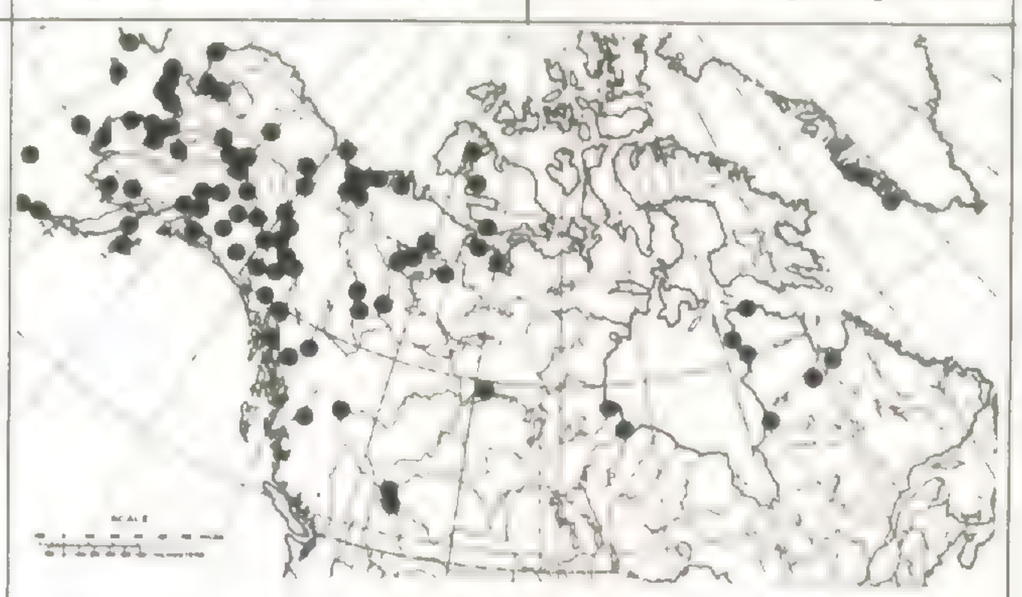


*Delphinium glaucum*

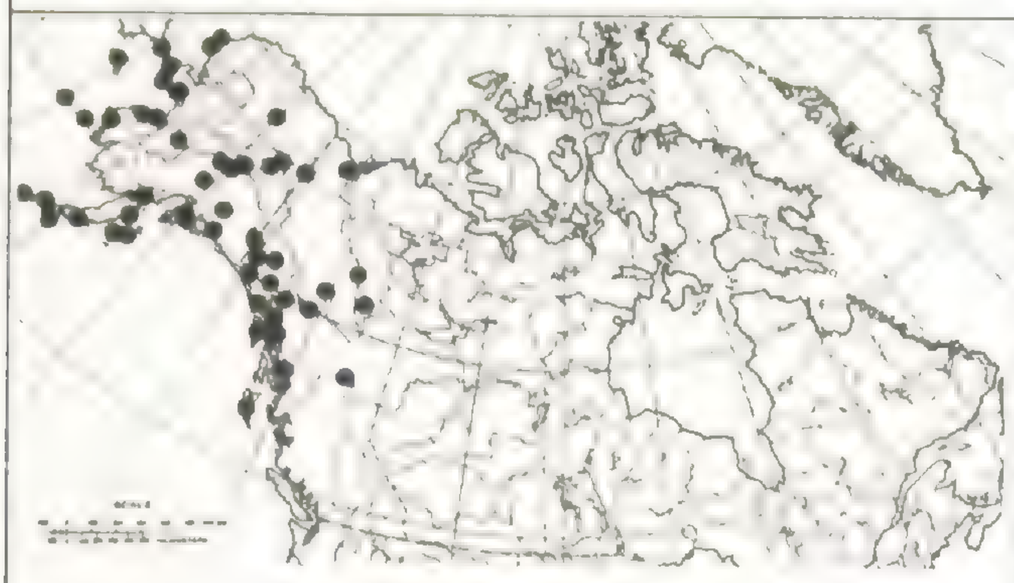


*Aconitum delphinifolium*

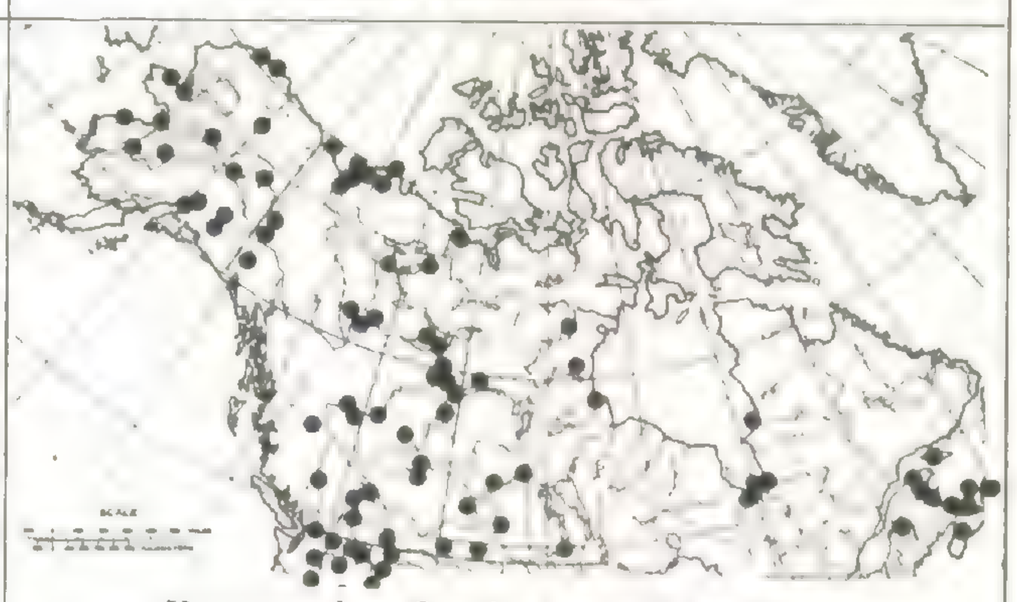
*Anemone parviflora*



*Anemone Richardsonii*



*Anemone narcissiflora*



*Ranunculus Gmelini var. Purshii*

*Ranunculus hyperboreus*

*Ranunculus nivalis*

*Ranunculus Eschscholtzii*

*Ranunculus lapponicus*

*Corydalis pauciflora*

*Draba fladnizensis var. heterotricha*

*Draba nivalis var. elongata*

*Draba longipes*

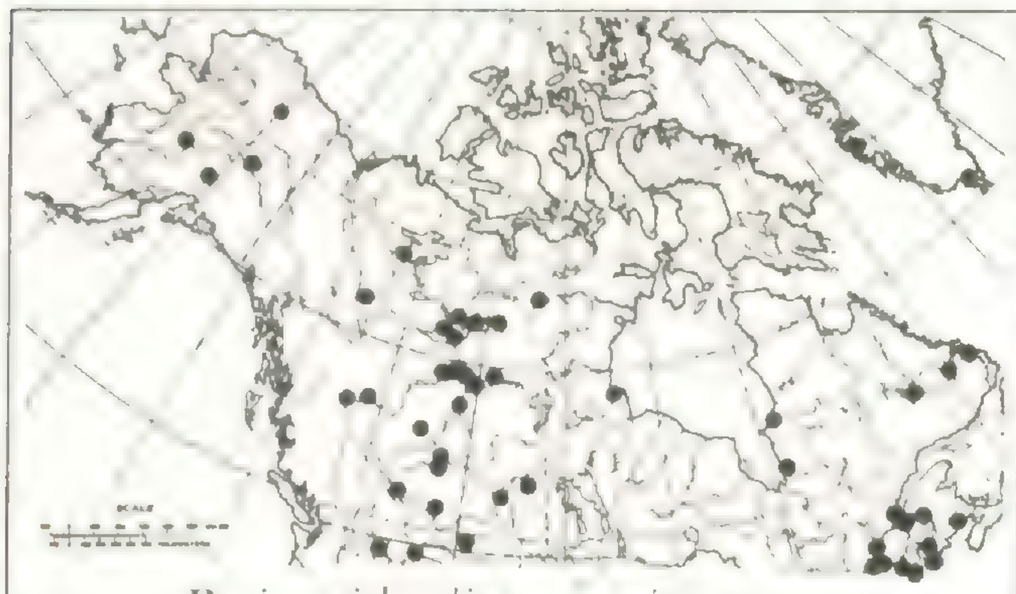
*Draba glabella*

*Draba McCallae*

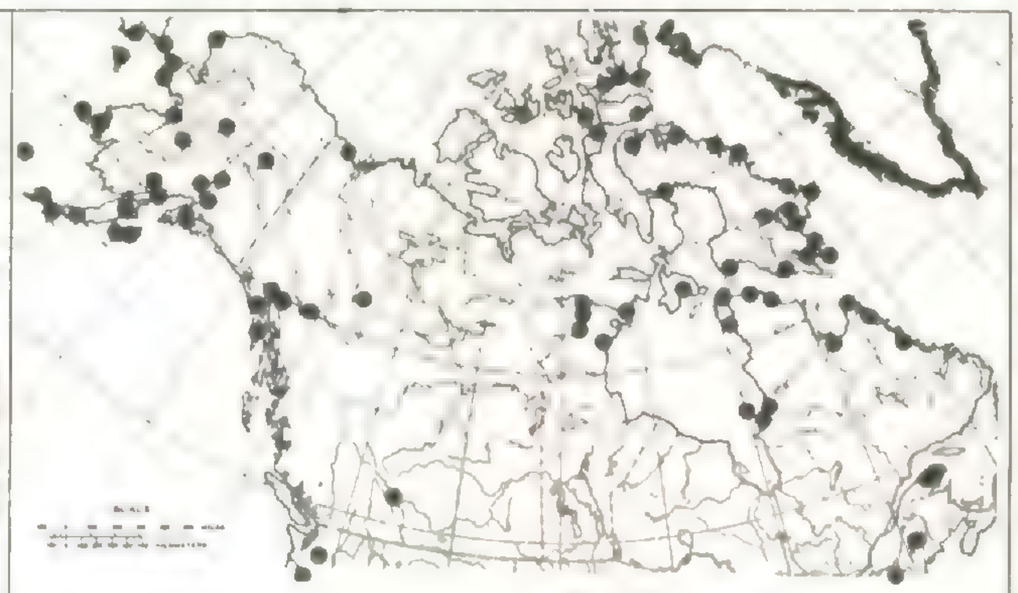
*Draba praealta*

*Draba lanceolata*

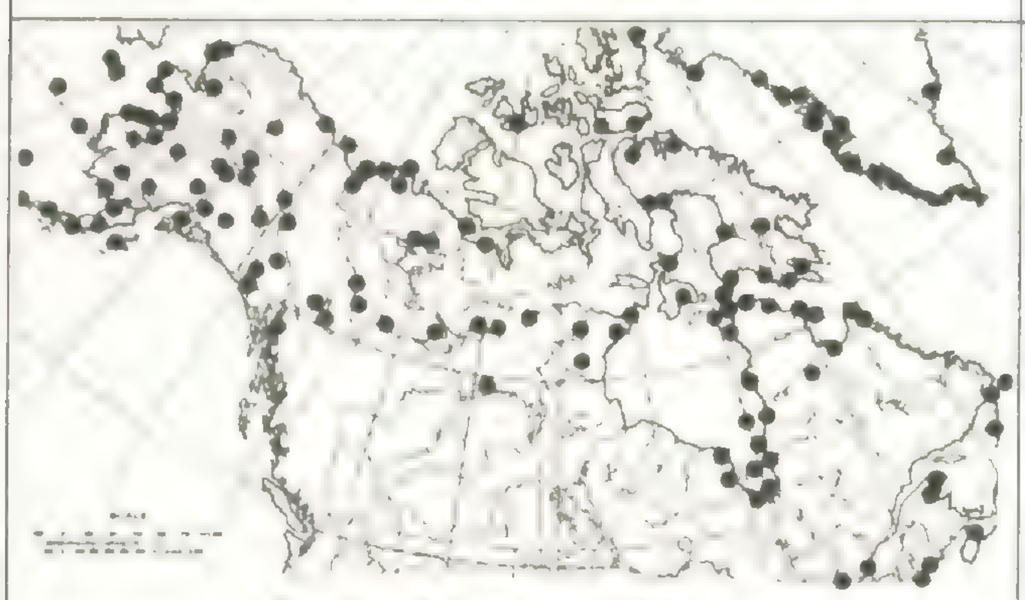
*Draba cinerea*



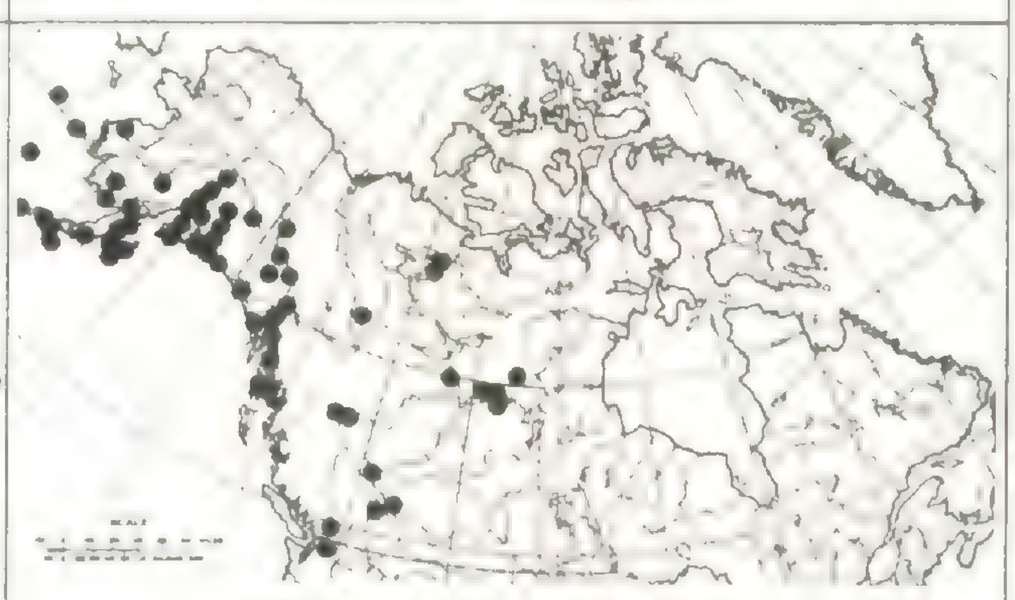
*Rorippa islandica var. microcarpa*



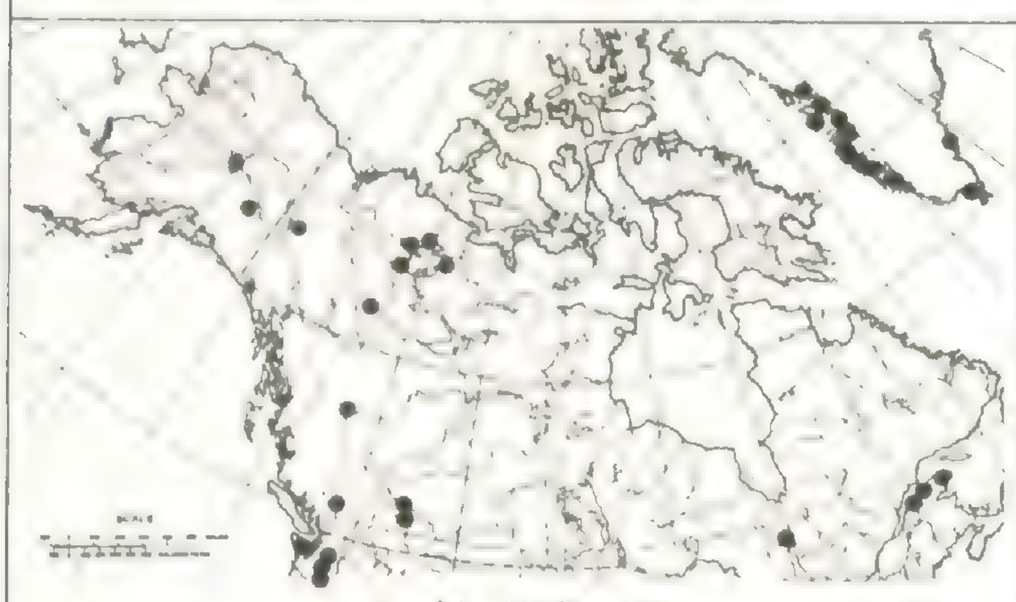
*Cardamine bellidifolia*



*Cardamine pratensis s.l.*

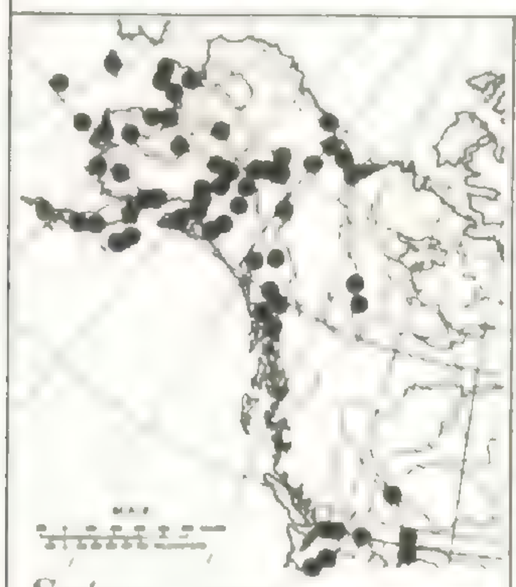


*Arabis lyrata var. kamchatica*

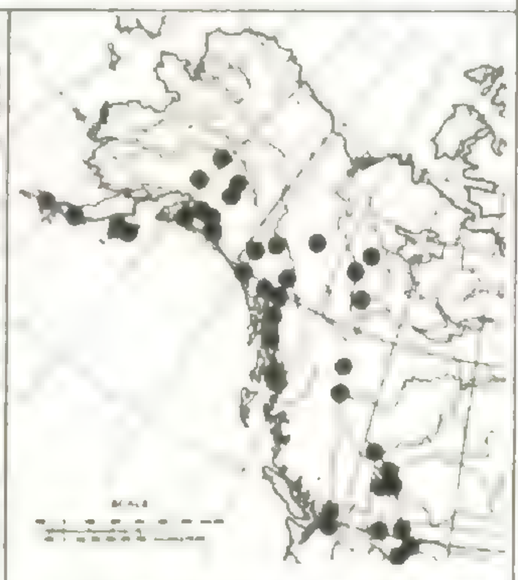


*Arabis Holboellii*

*Arabis Drummondii*

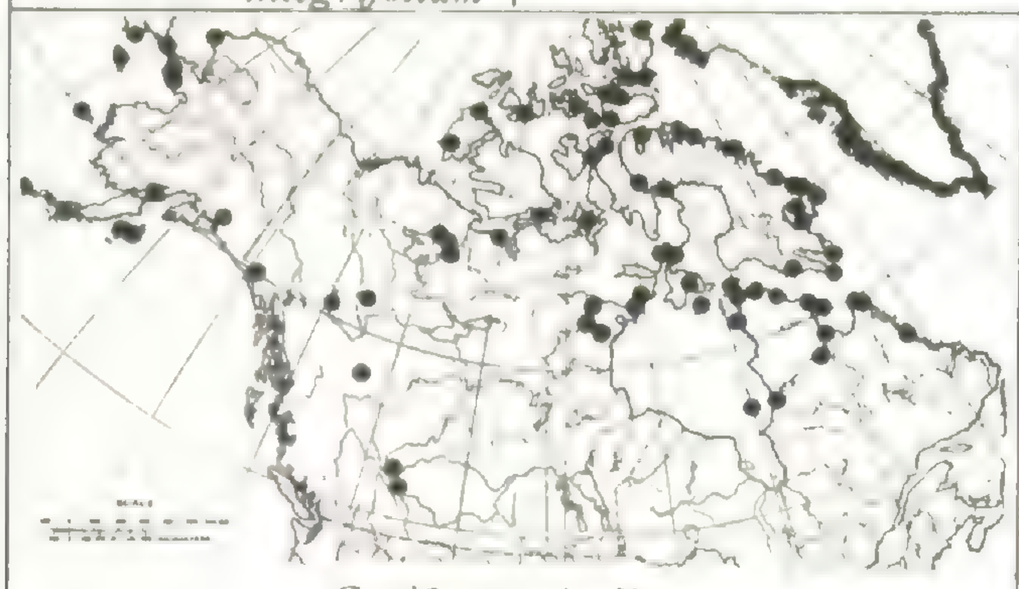


*Sedum roseum var. integrifolium*



*Saxifraga Lyallii*

*Saxifraga rivularis*



*Saxifraga nivalis*

*Saxifraga punctata*

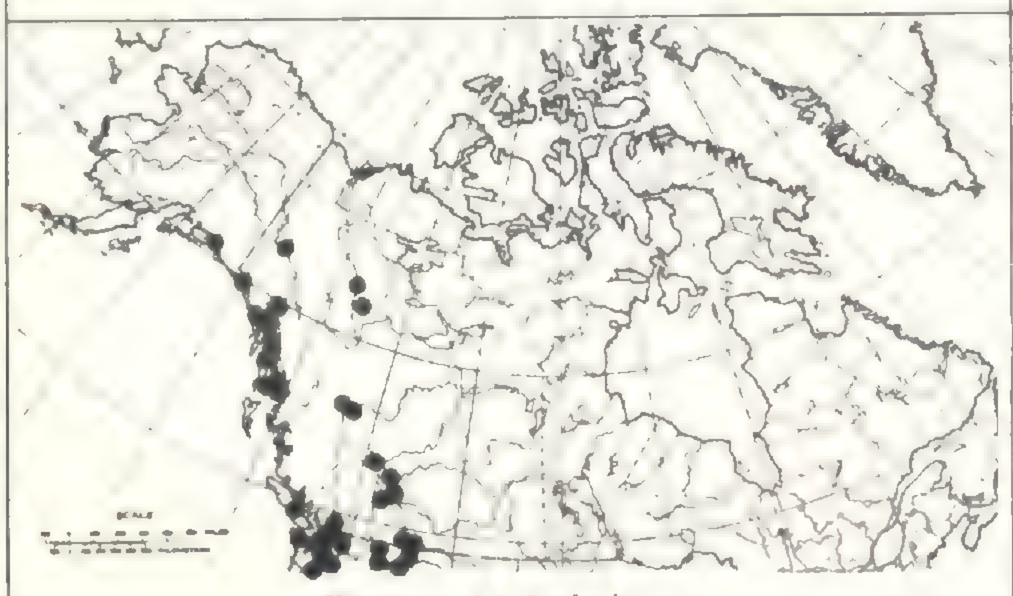
*Saxifraga radiata*

*Saxifraga aizoides*

*Saxifraga tricuspidata*

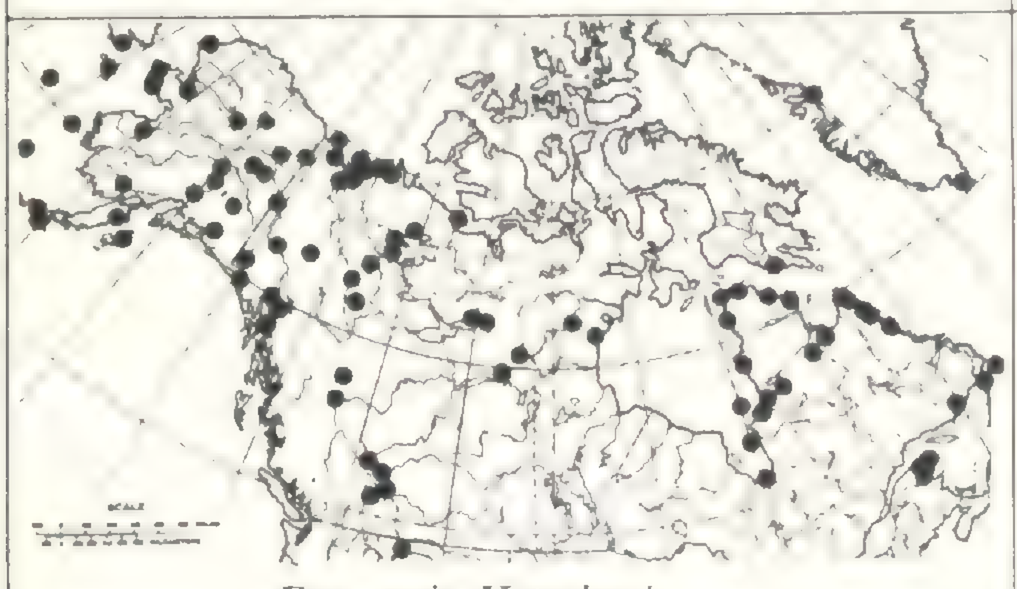
*Saxifraga oppositifolia*

*Chrysosplenium tetrandrum*

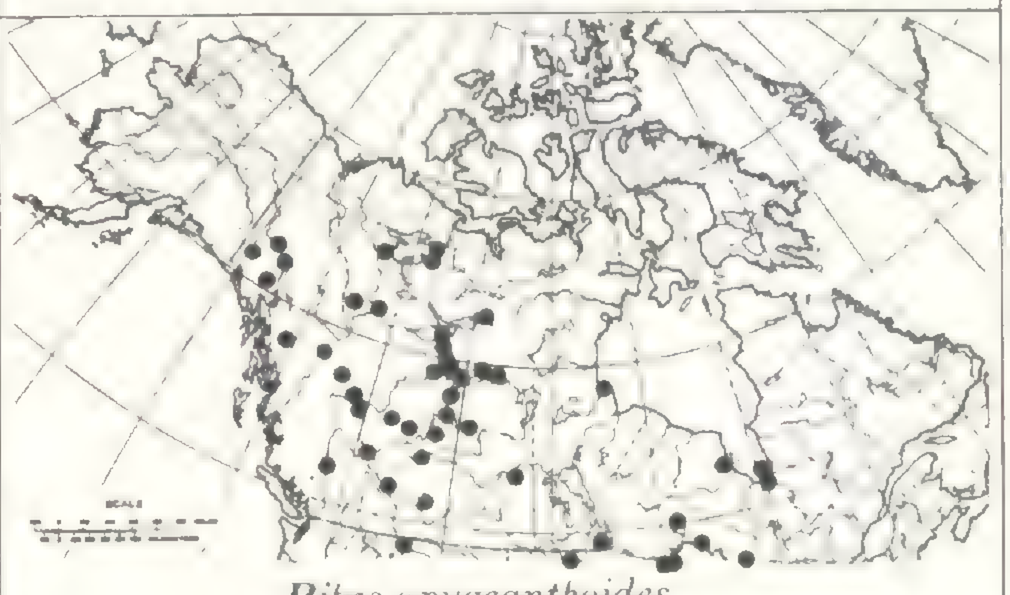


*Parnassia fimbriata*

*Parnassia palustris var. neogaea*



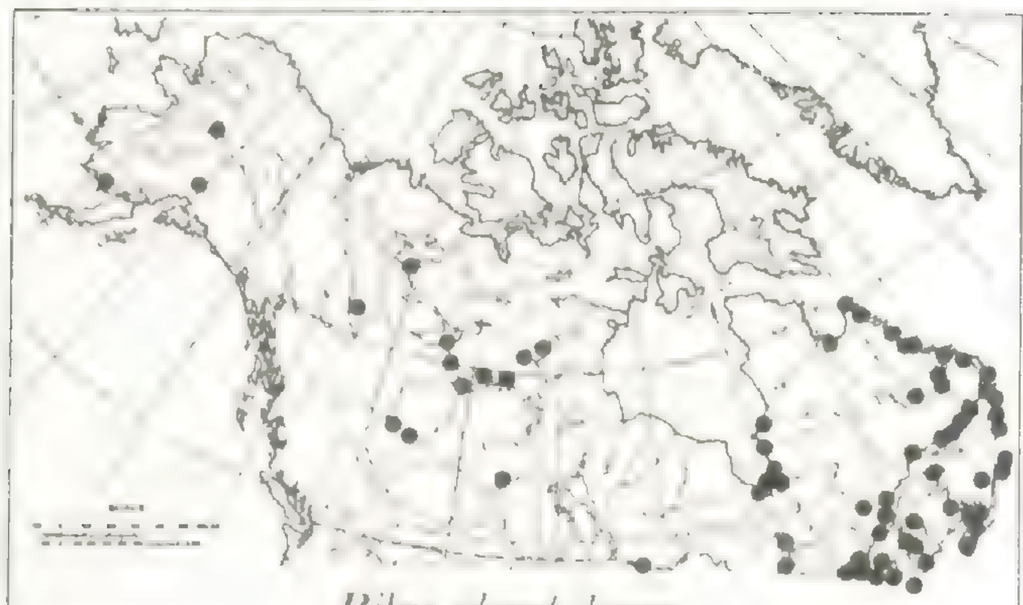
*Parnassia Kotzebuei*



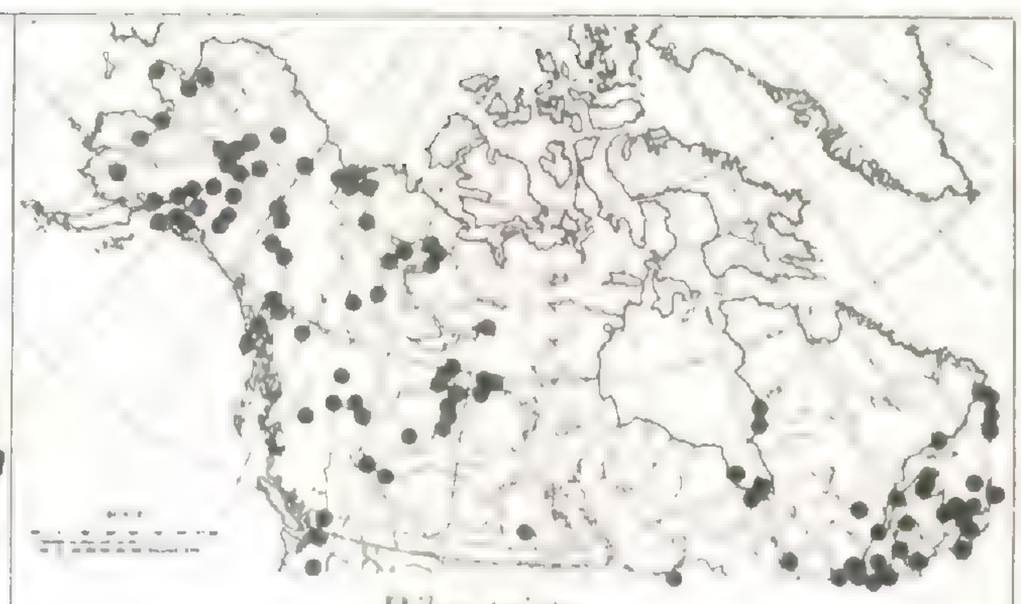
*Ribes oxyacanthoides*

*Ribes hudsonianum*

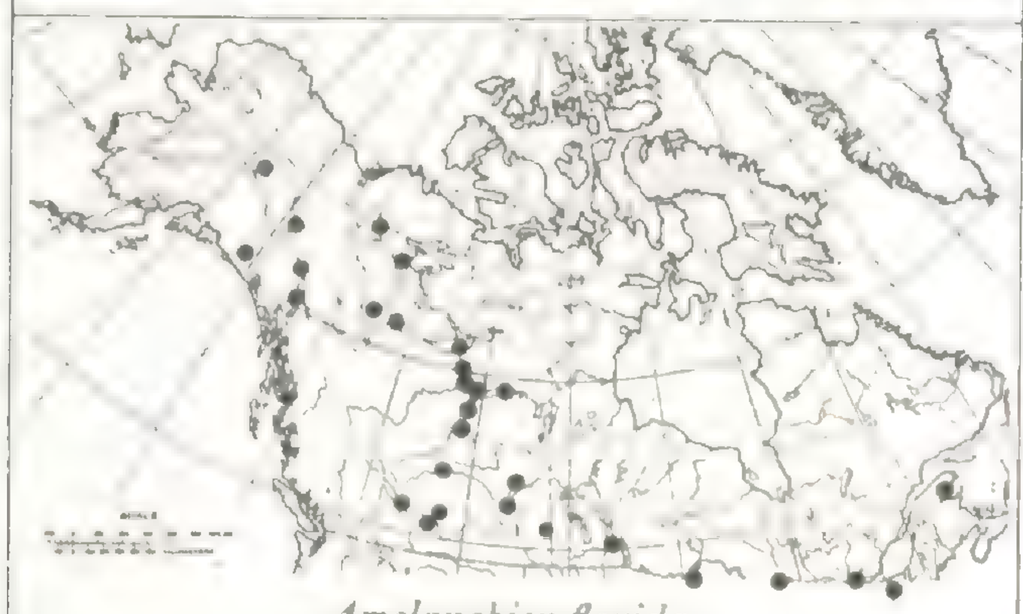
*Ribes lacustre*



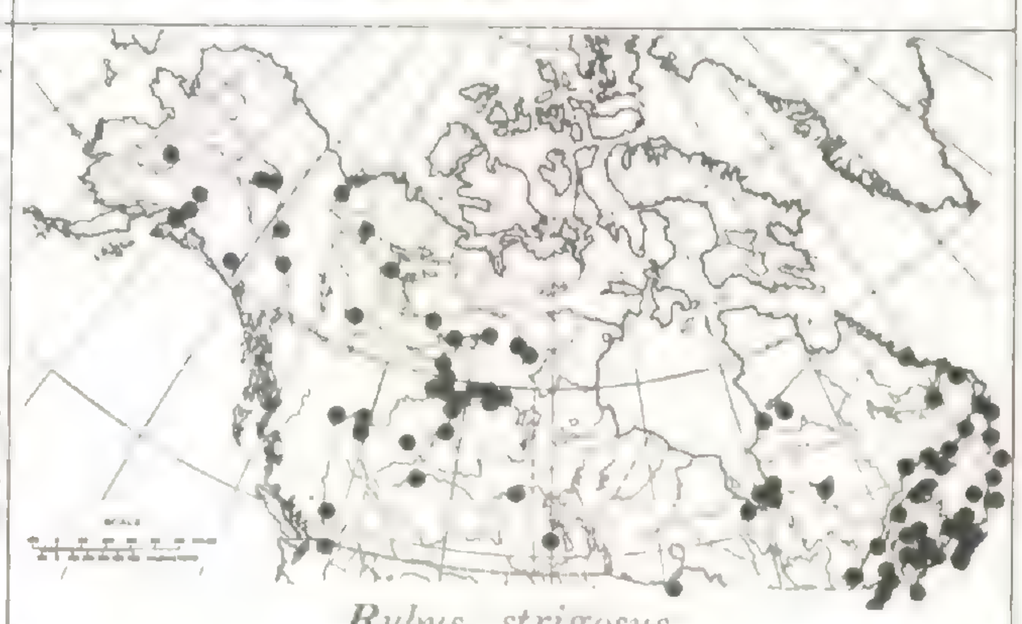
*Ribes glandulosum*



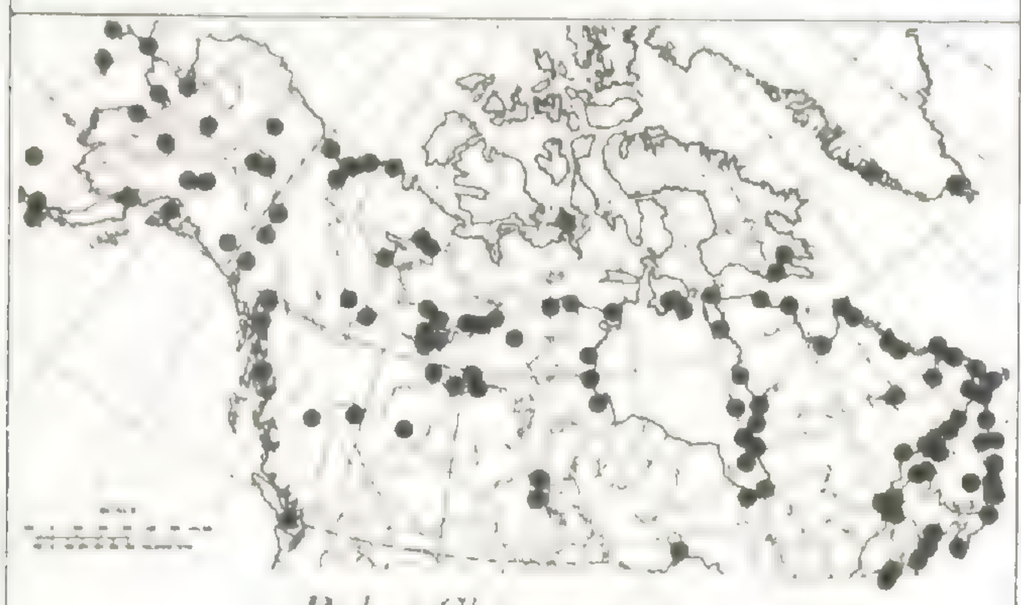
*Ribes triste*



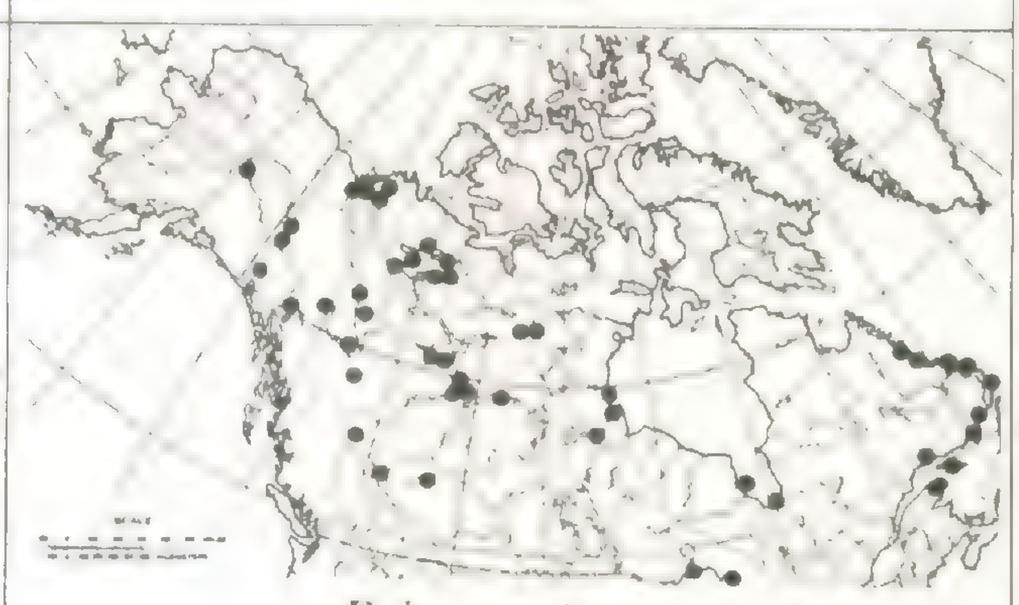
*Amelanchier florida*



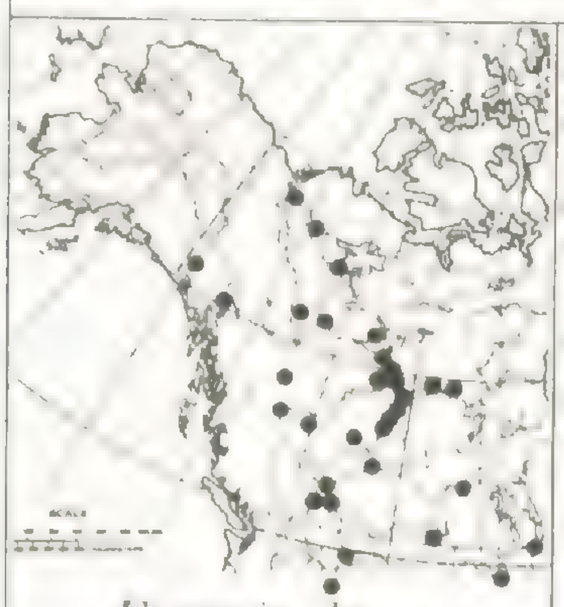
*Rubus strigosus*



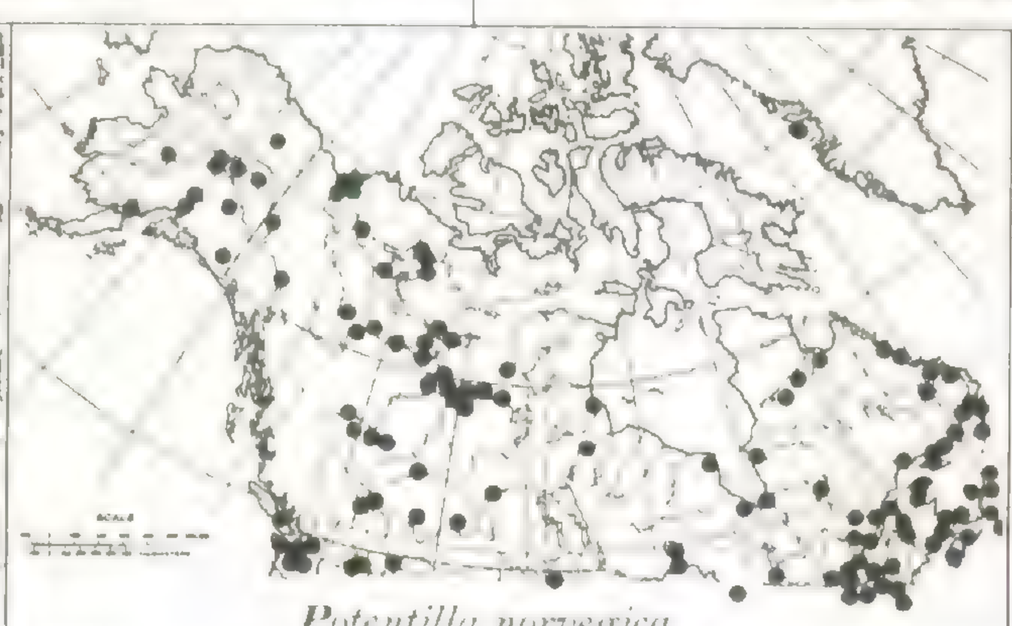
*Rubus Chamaemorus*



*Rubus acaulis*



*Fragaria glauca*



*Potentilla norvegica*

*Potentilla diversifolia var. glaucophylla*



*Potentilla emarginata*

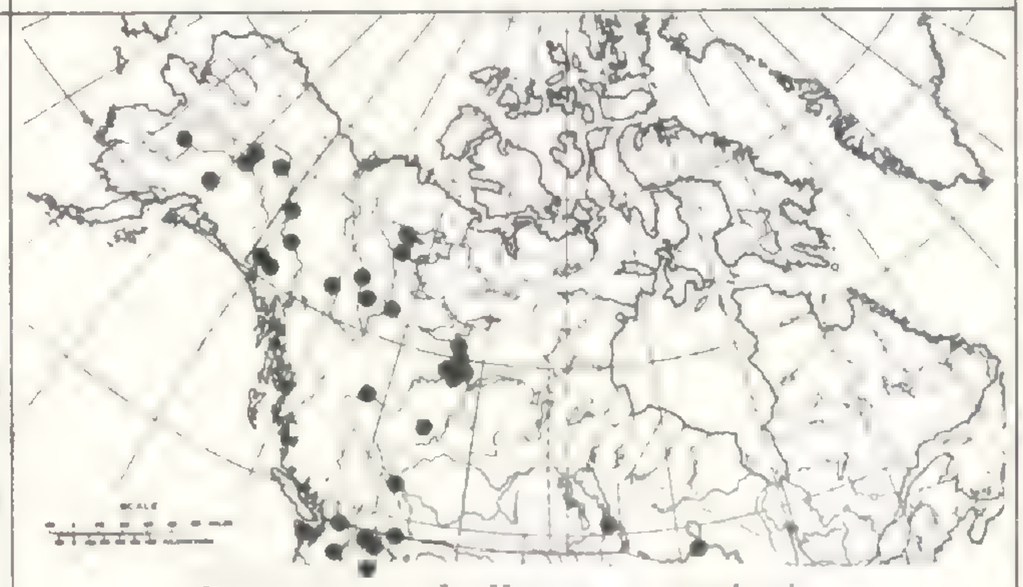


*Potentilla nivea s.l.*

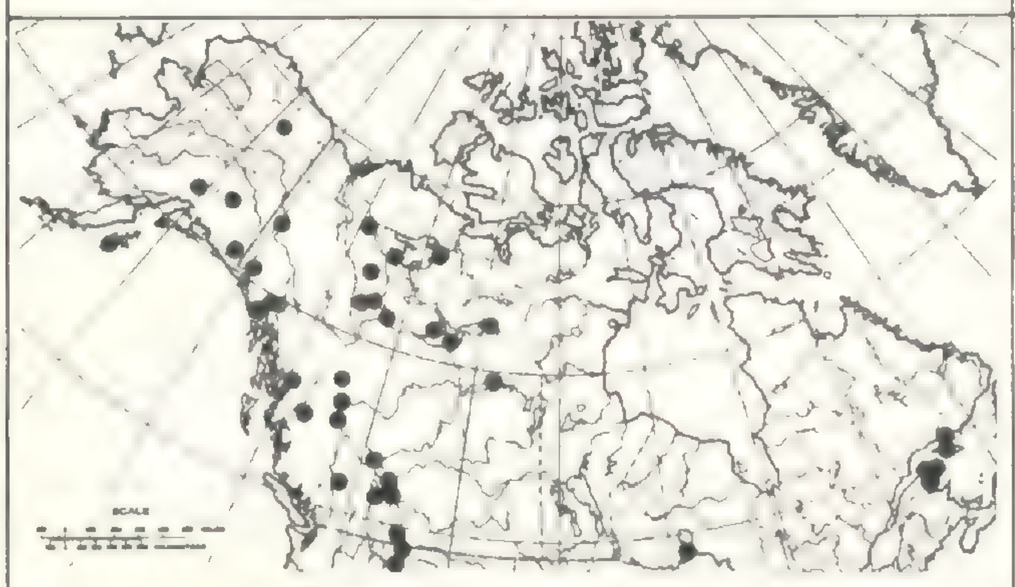
*Potentilla uniflora*

*Potentilla fruticosa*

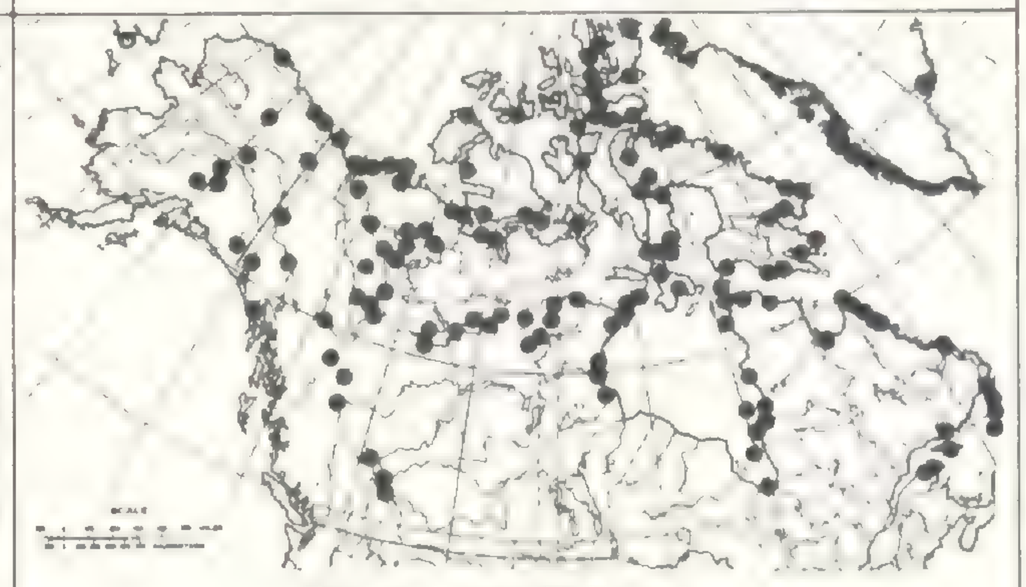
*Sibbaldia procumbens*



*Geum macrophyllum var. perincisum*

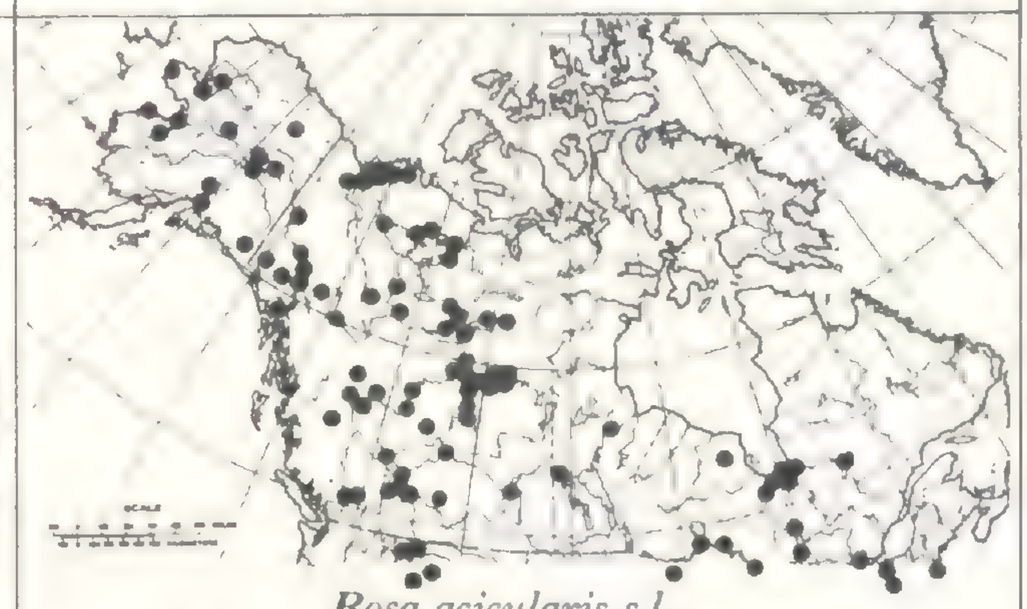


*Dryas Drummondii*

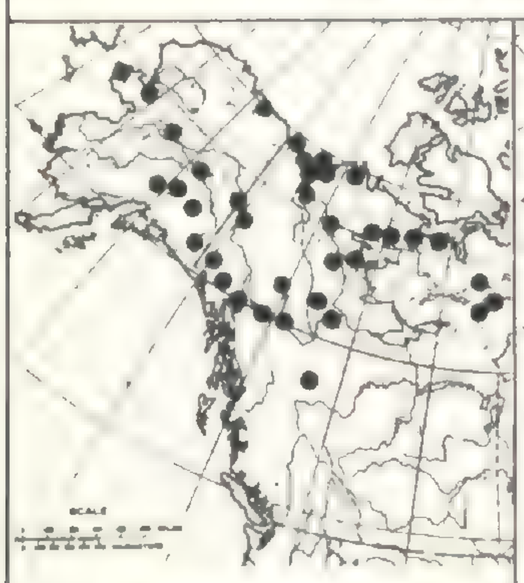


*Dryas integrifolia s.l.*

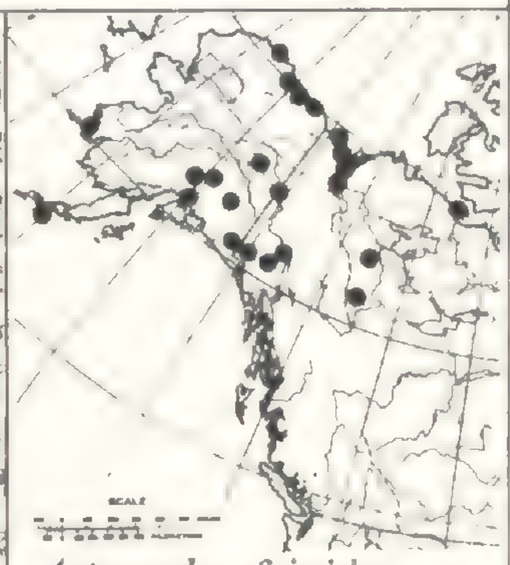
*Dryas octopetala*



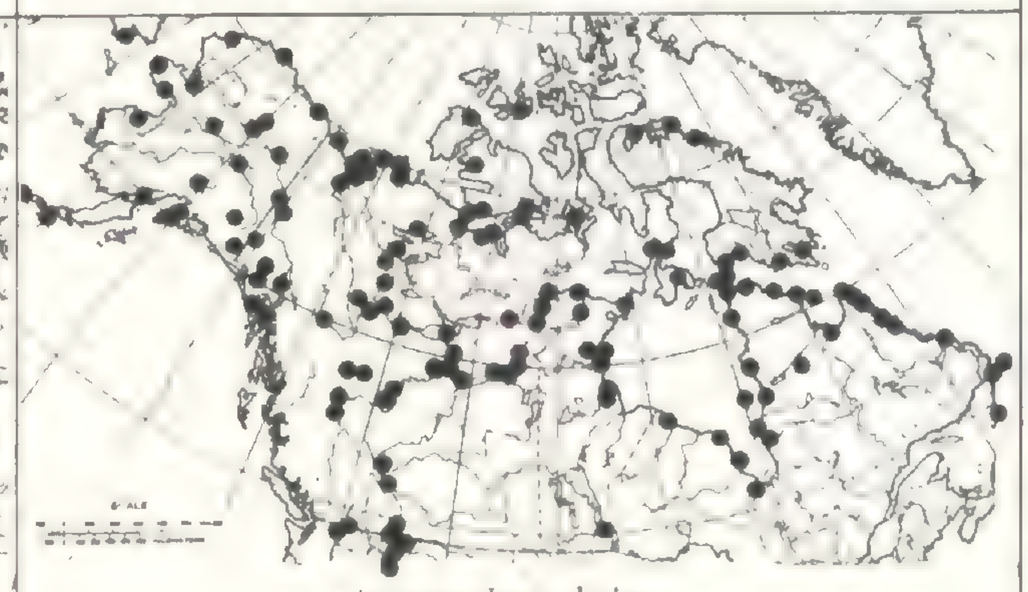
*Rosa acicularis s.l.*



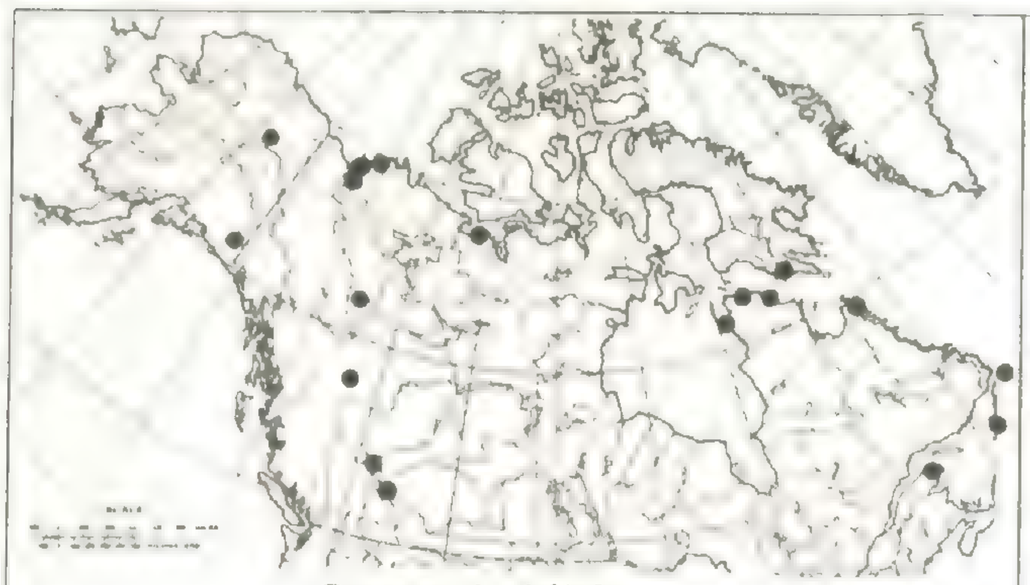
*Lupinus arcticus*



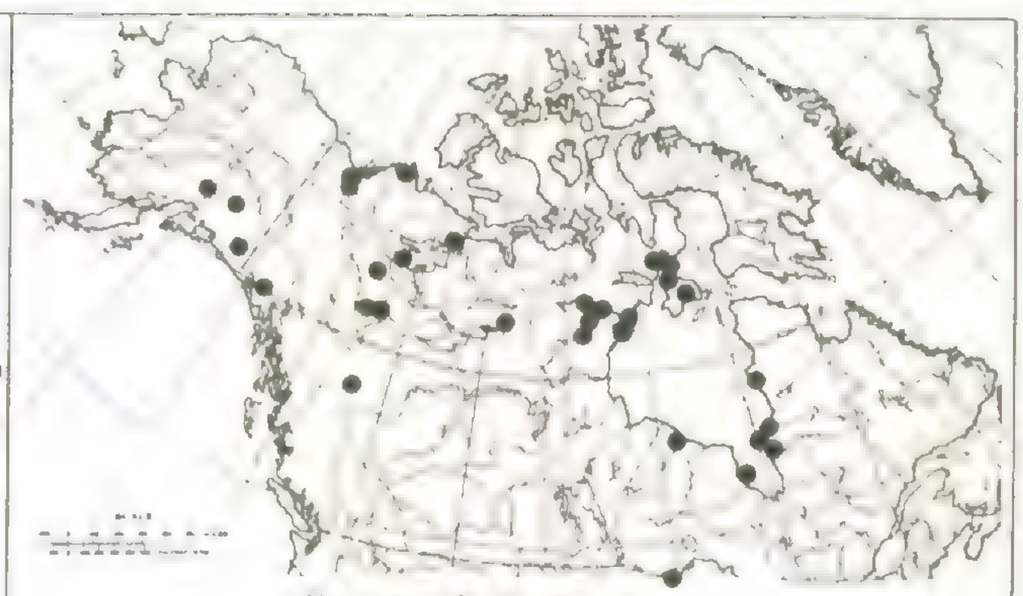
*Astragalus frigidus var. littoralis*



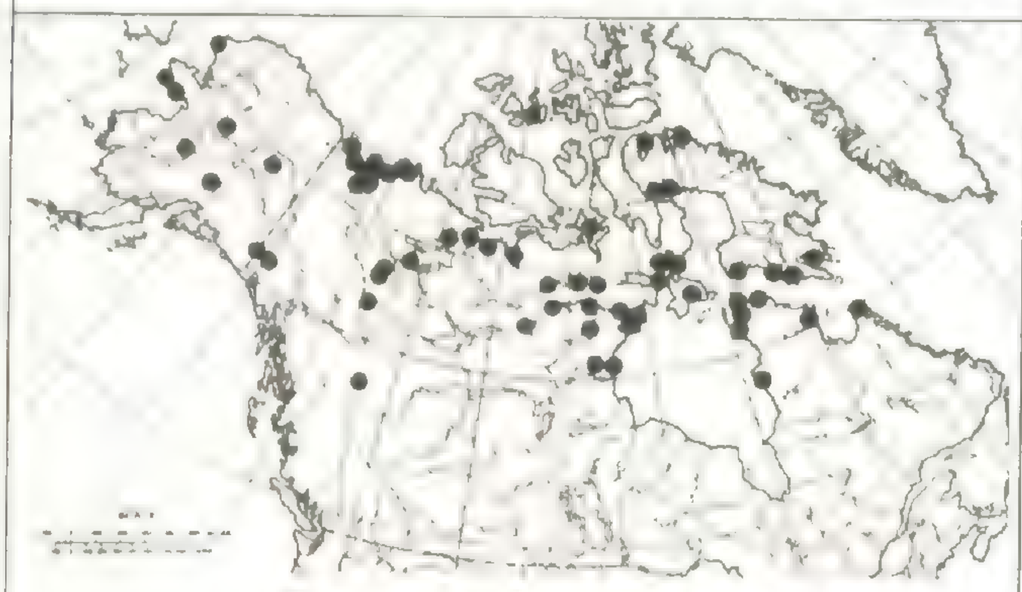
*Astragalus alpinus*



*Oxytropis foliolosa*

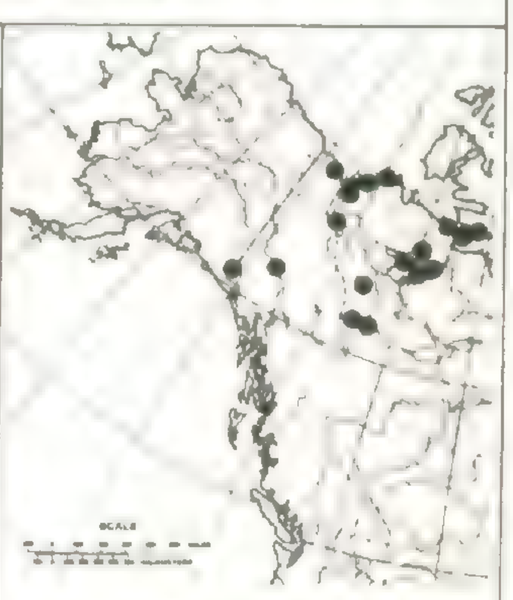


*Oxytropis hudsonica*



*Oxytropis Maydelliana*

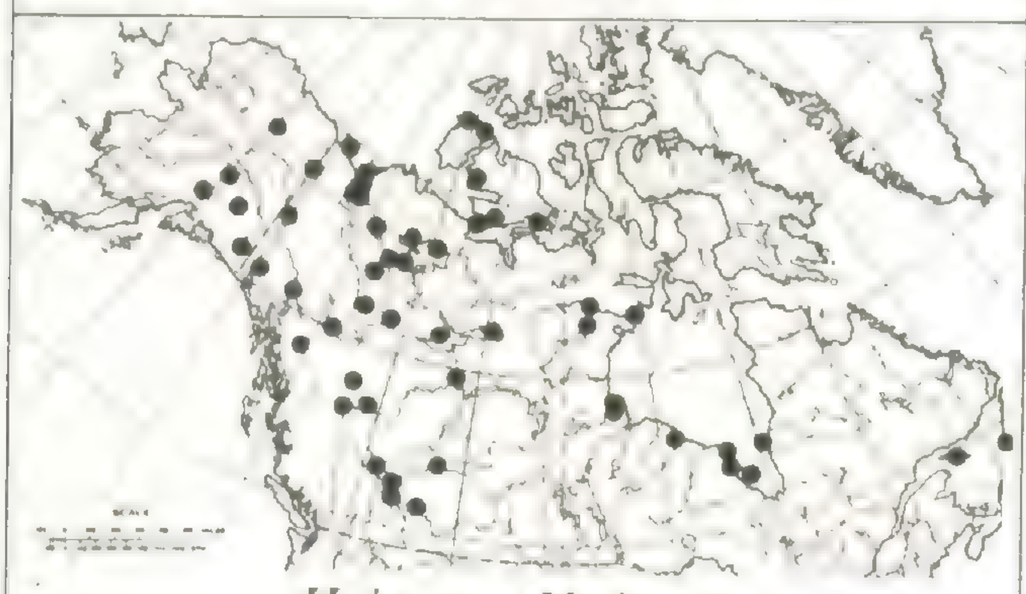
*Oxytropis pygmaea*



*Oxytropis hyperborea*

*Oxytropis ixodes*

*Hedysarum alpinum var. americanum*

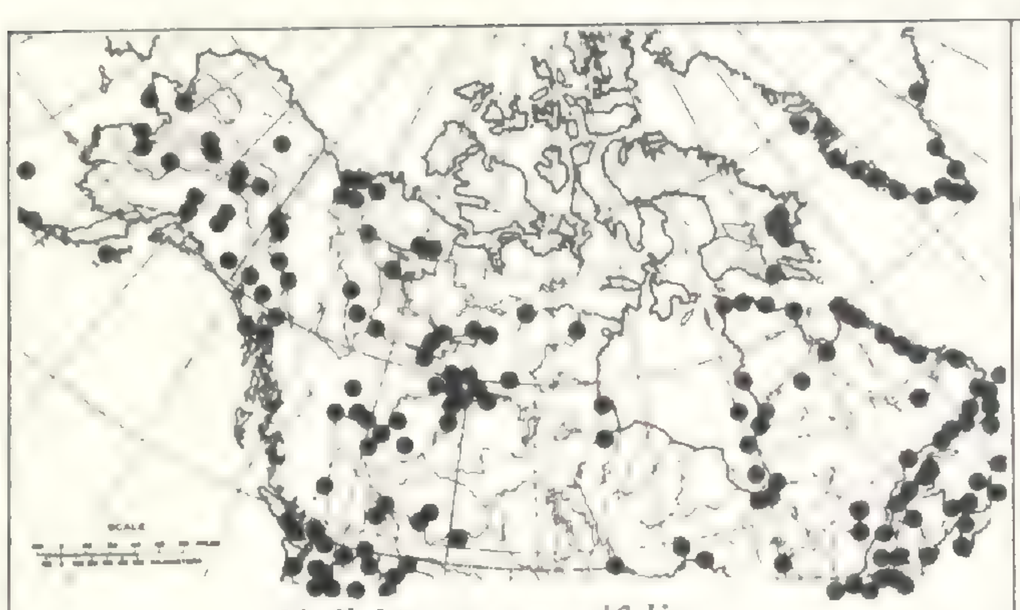


*Hedysarum Mackenzii*

*Empetrum nigrum*

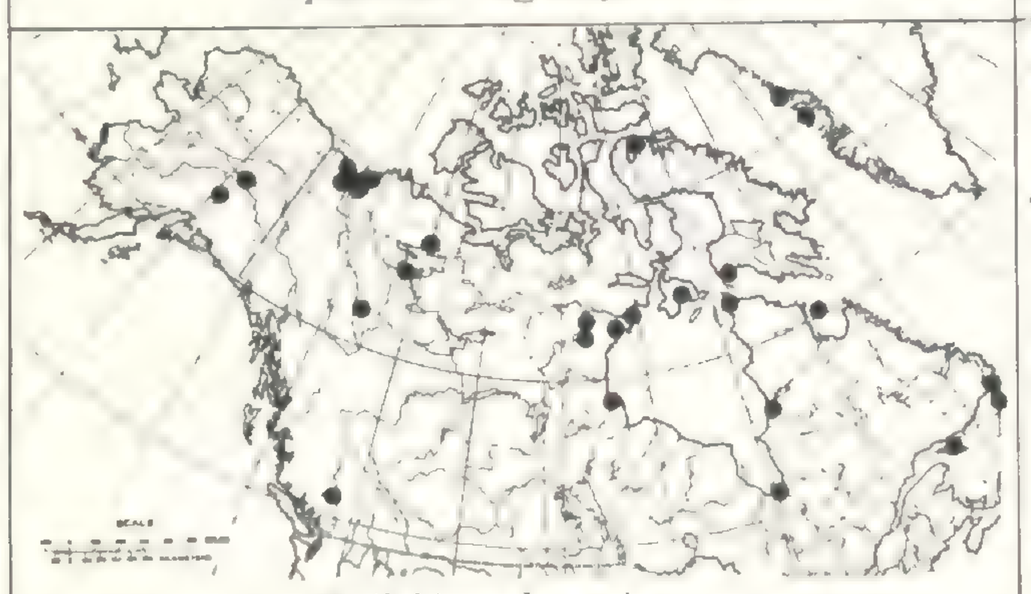
*Viola epipsila*

*Shepherdia canadensis*

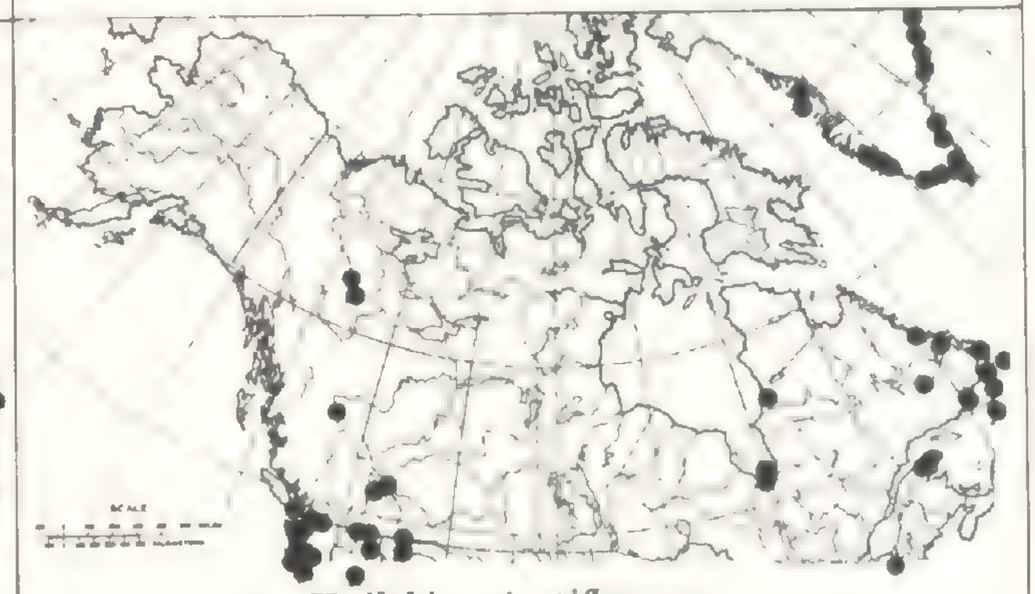


*Epilobium angustifolium*

*Epilobium latifolium*



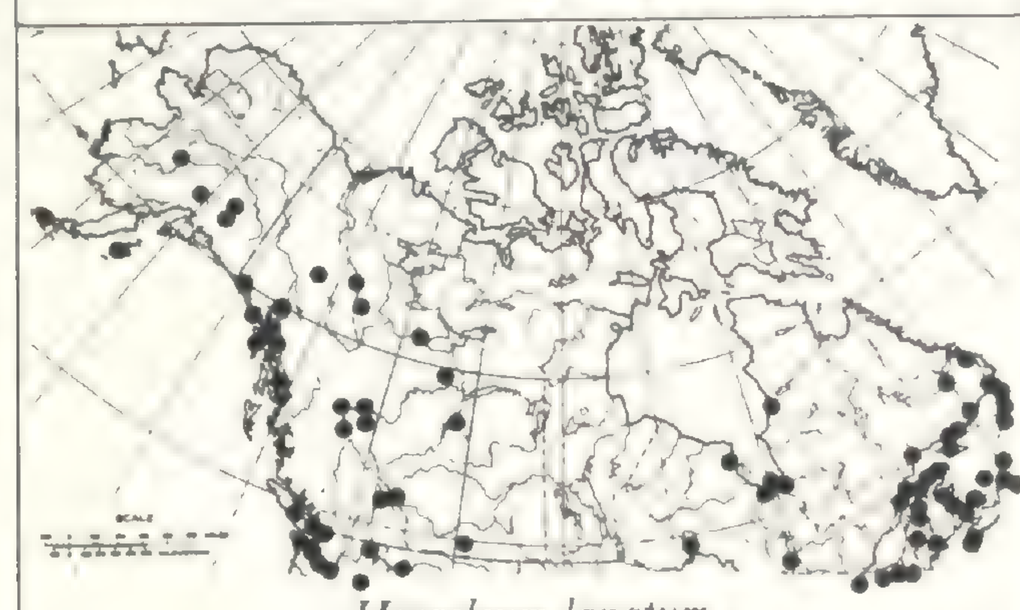
*Epilobium davuricum*



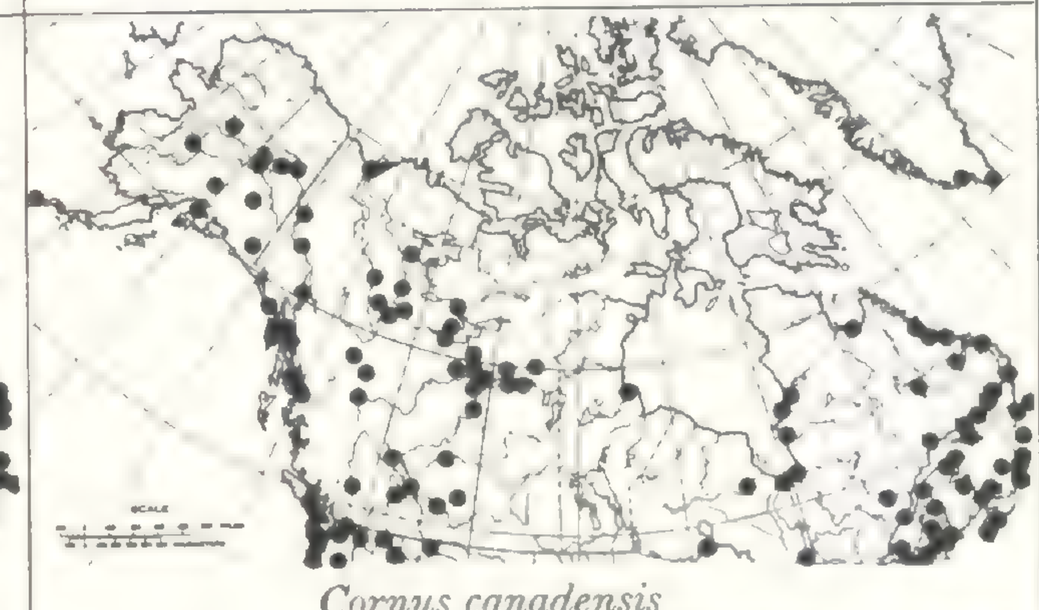
*Epilobium lactiflorum*

*Epilobium angallidifolium*

*Hippuris montana*

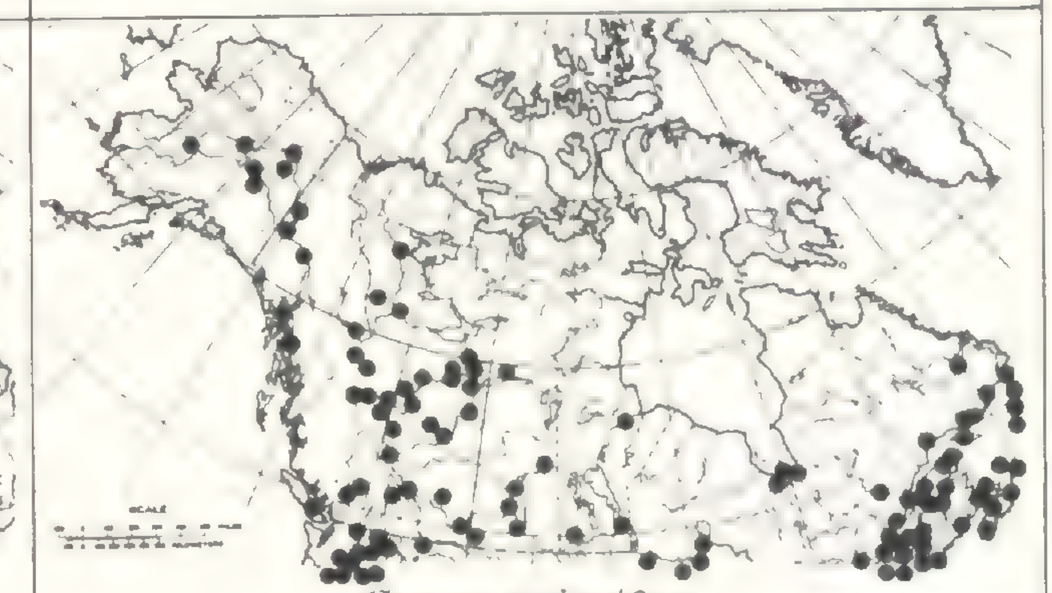


*Heracleum lanatum*

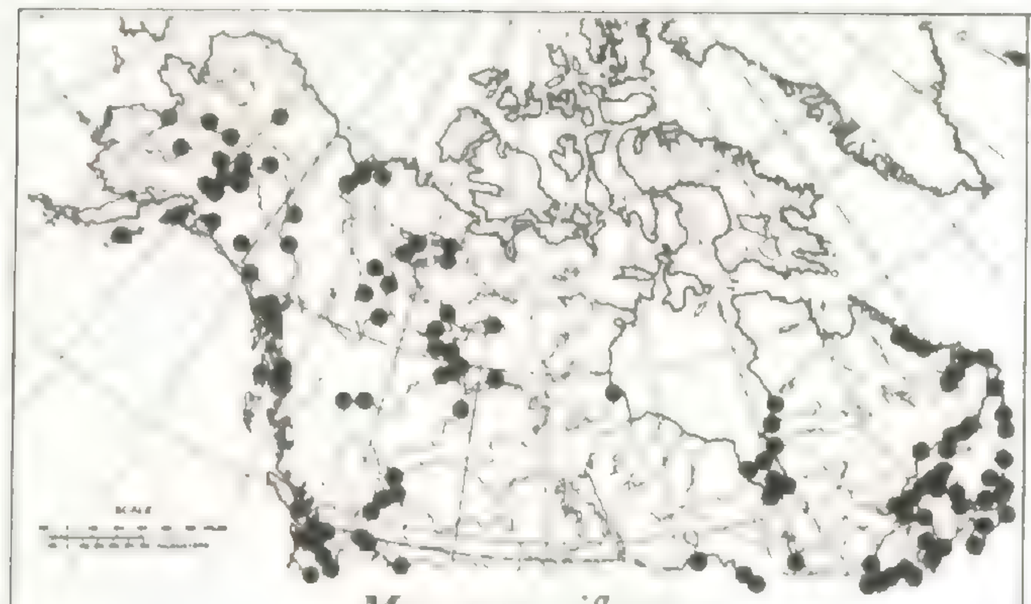


*Cornus canadensis*

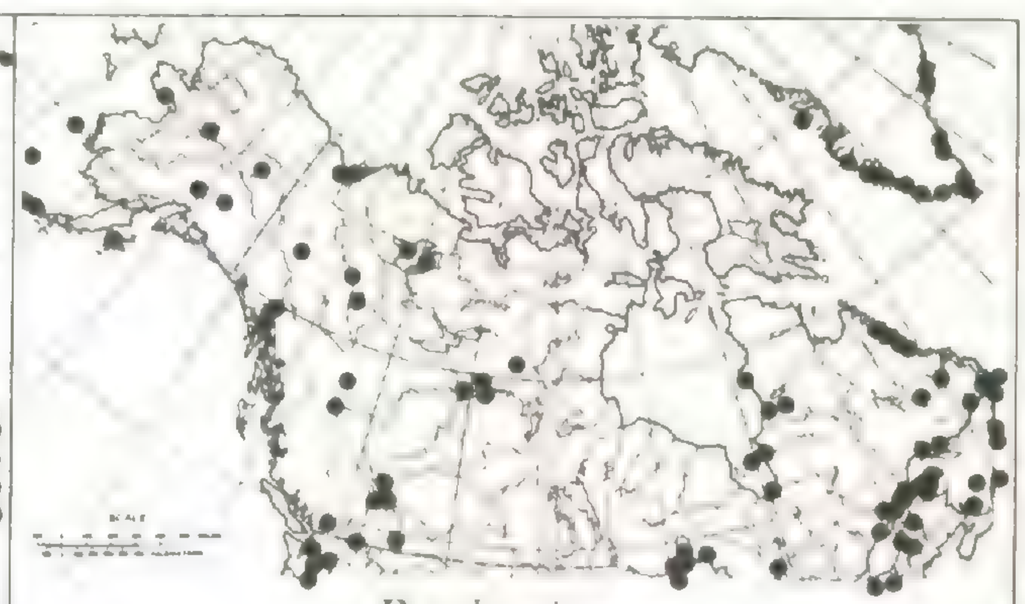
*Cornus canadensis f. purpurascens*



*Cornus stolonifera*



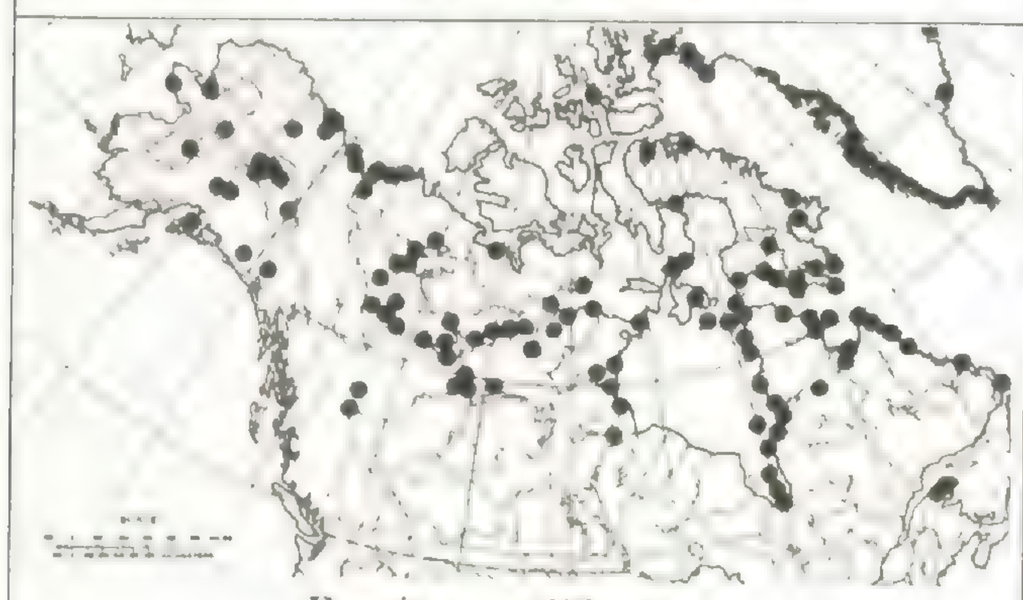
*Moneses uniflora*



*Pyrola minor*

*Pyrola secunda*

*Pyrola virens*

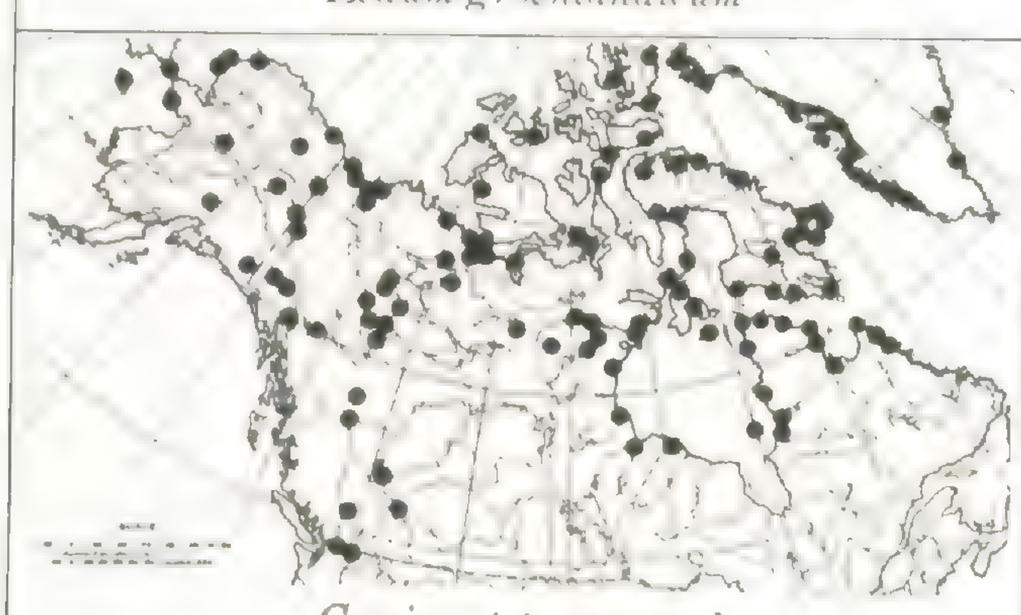


*Pyrola grandiflora s.l.*

*Pyrola asarifolia var. incarnata*

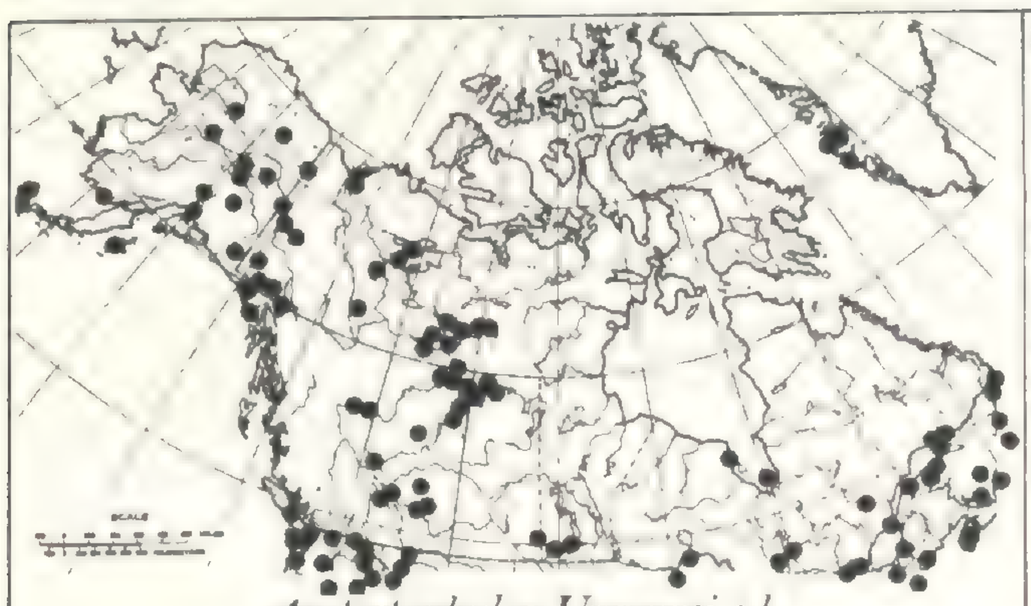
*Ledum groenlandicum*

*Phyllodoce glanduliflora*

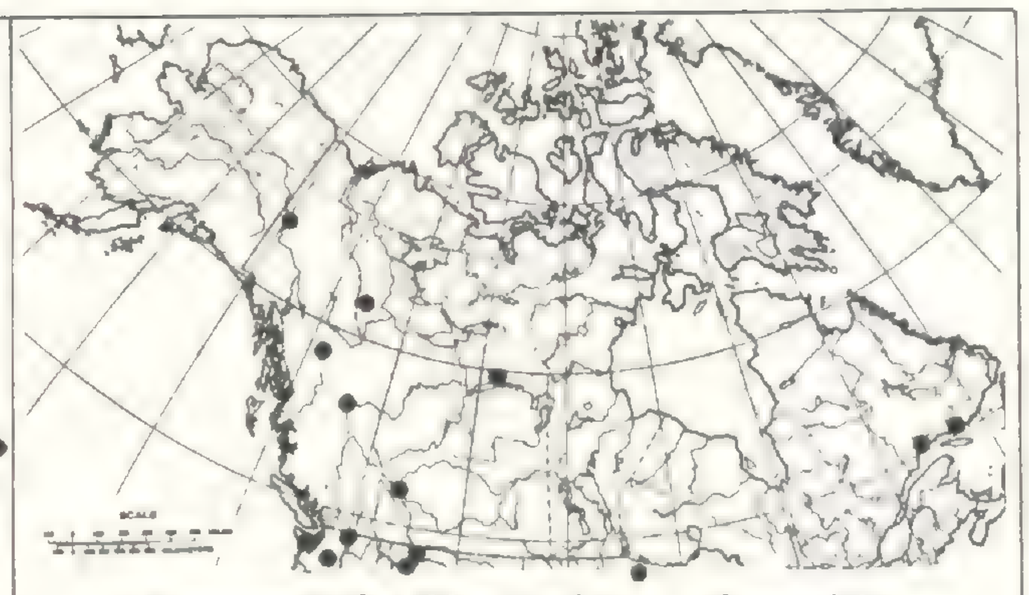


*Cassiope tetragona s.l.*

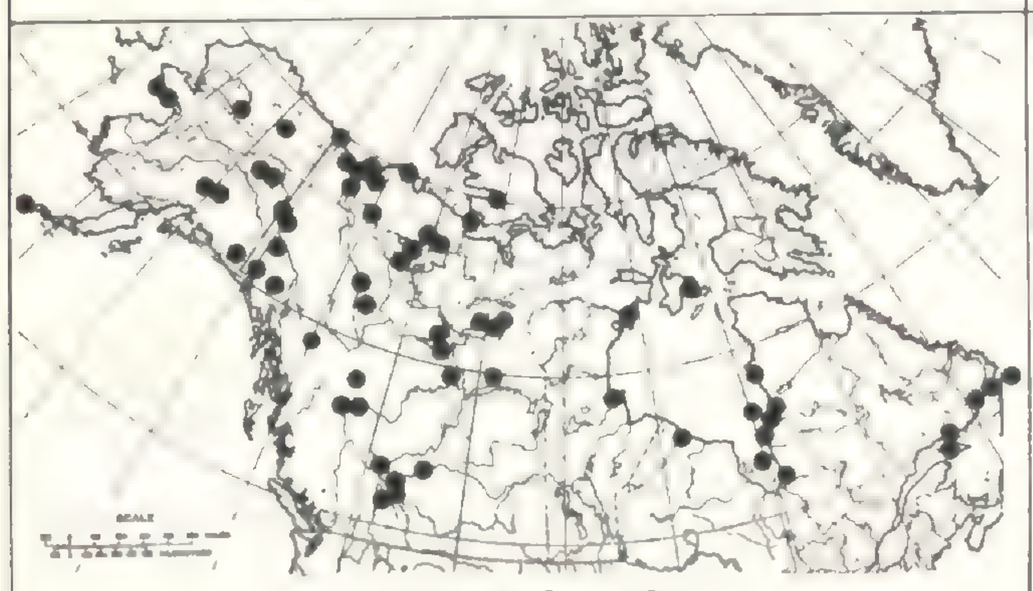
*Andromeda Polifolia*



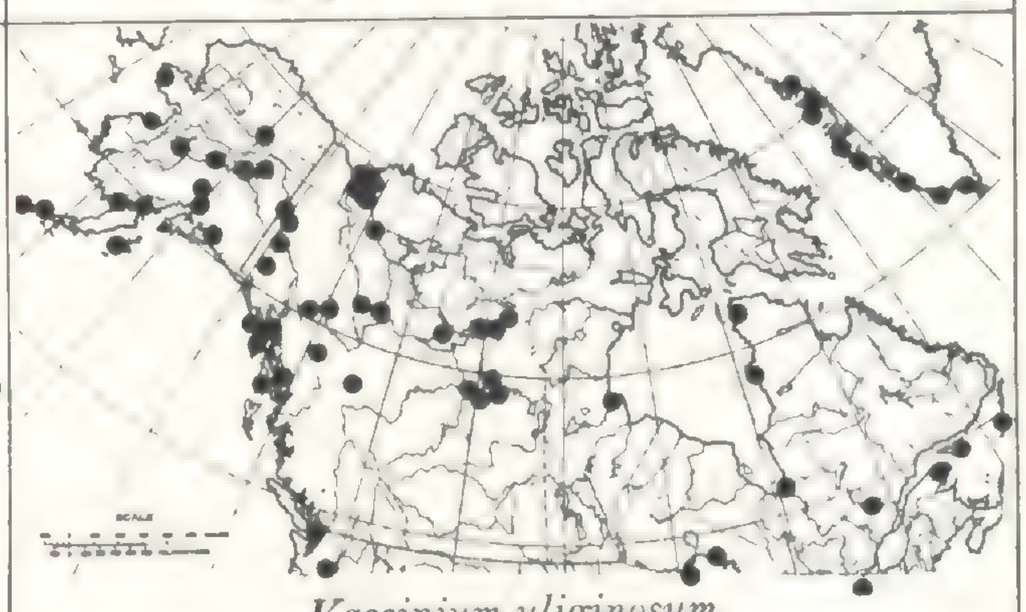
*Arctostaphylos Uva-ursi s.l.*



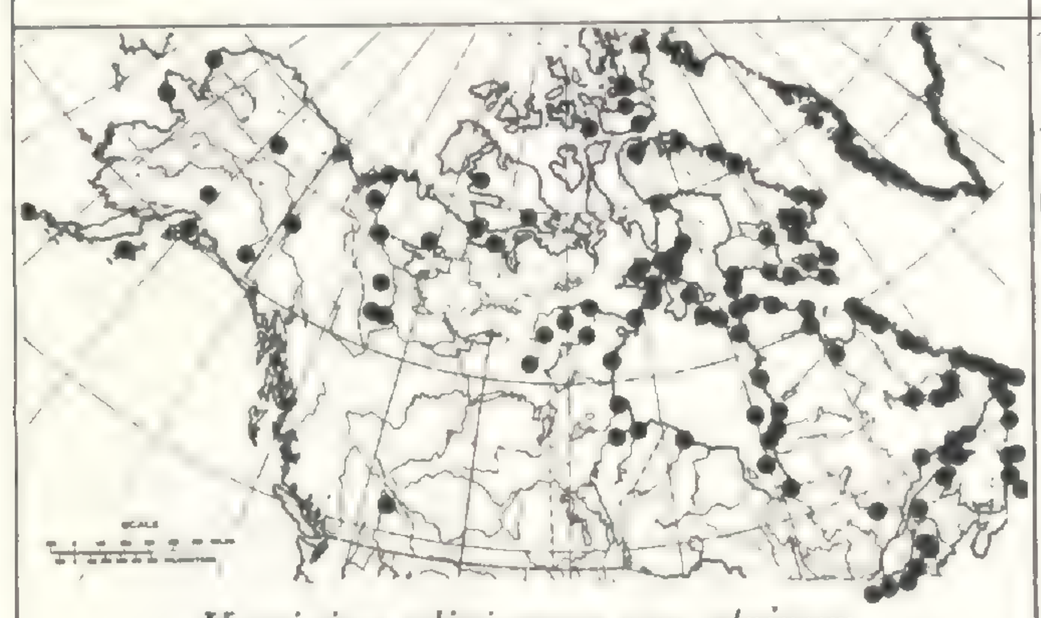
*Arctostaphylos Uva-ursi var. adenotricha*



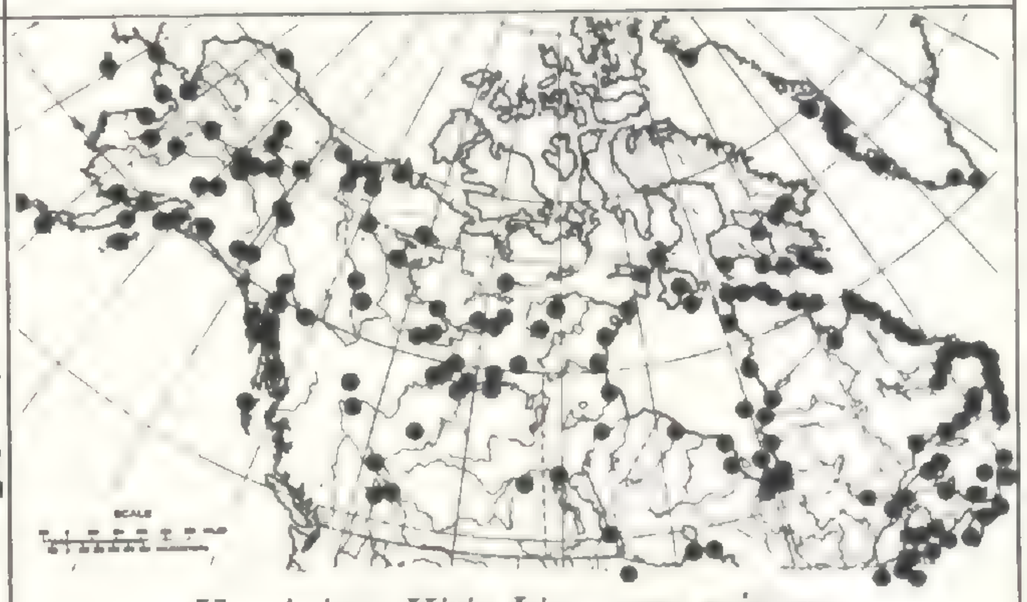
*Arctostaphylos rubra*



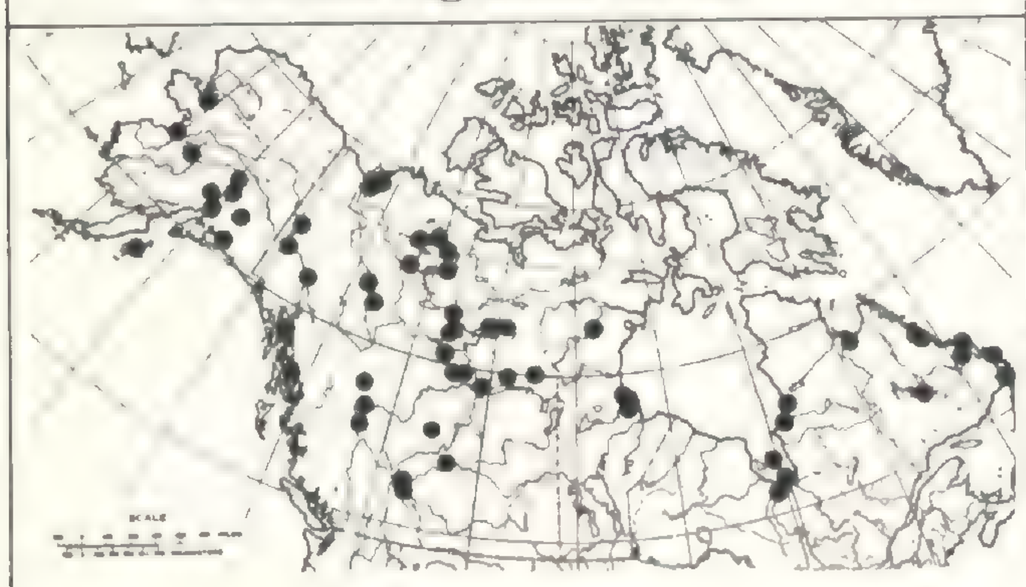
*Vaccinium uliginosum*



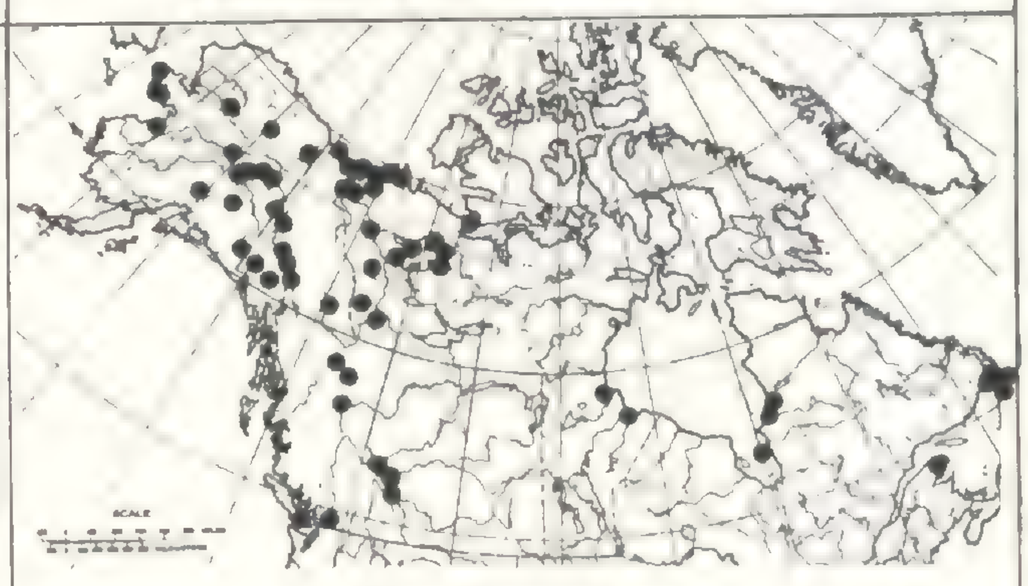
*Vaccinium uliginosum var. alpinum*



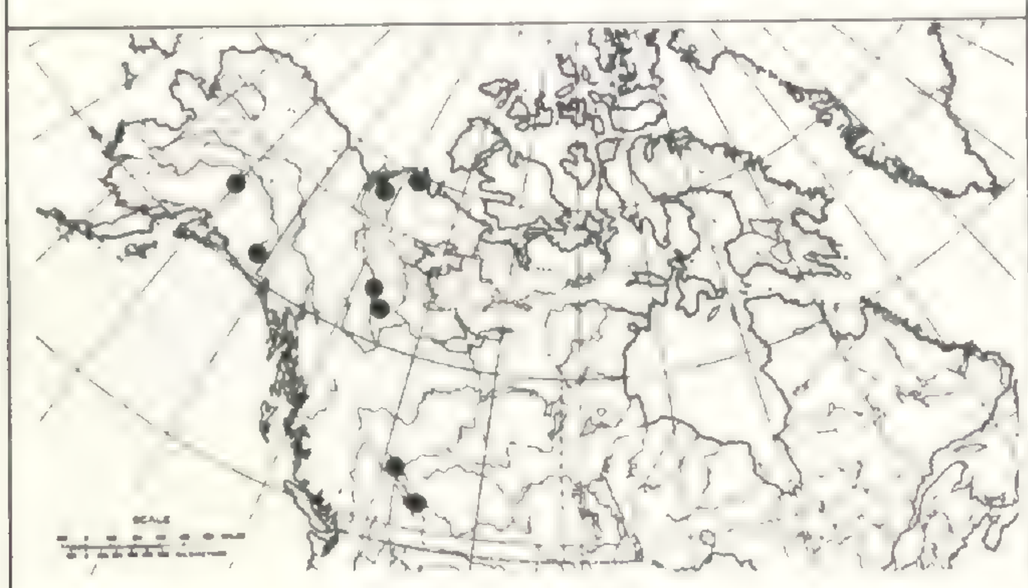
*Vaccinium Vitis-Idaea var. minus*



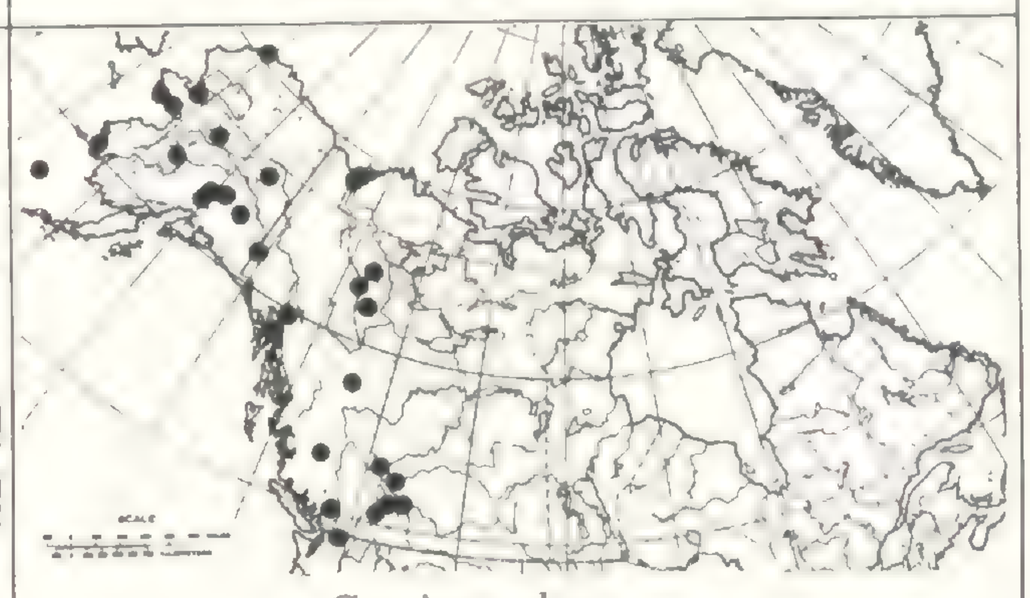
*Vaccinium microcarpum*



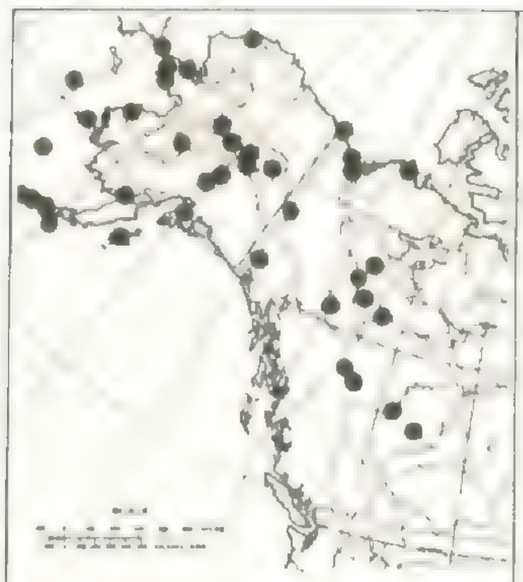
*Gentiana propinqua*



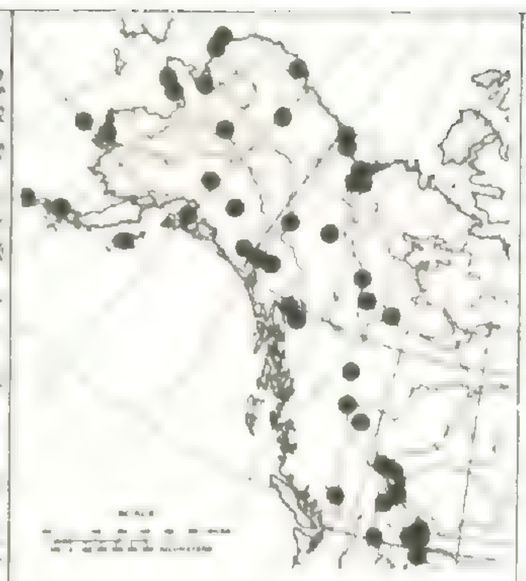
*Gentiana arctophila*



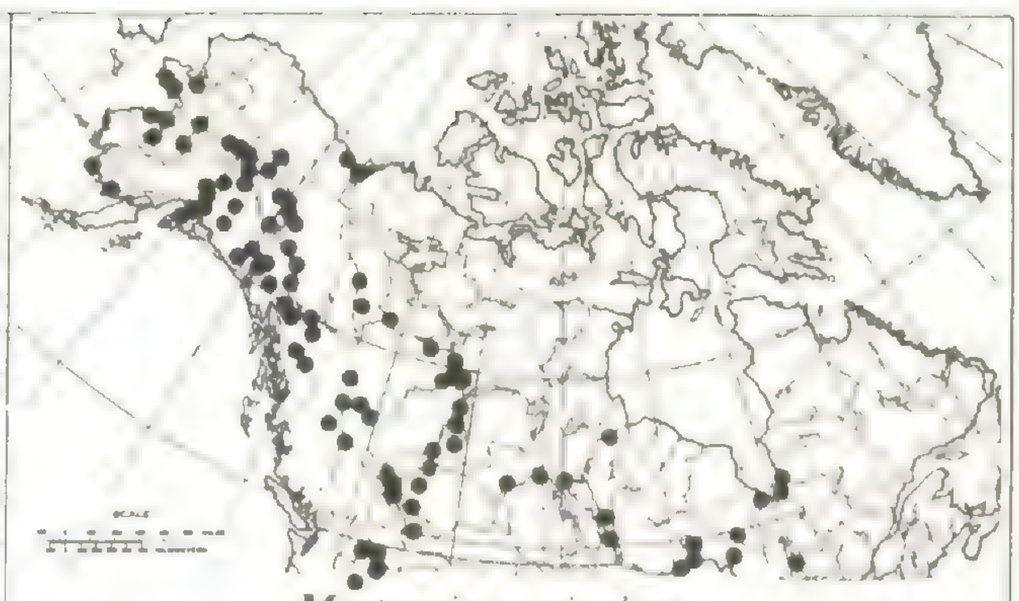
*Gentiana glauca*



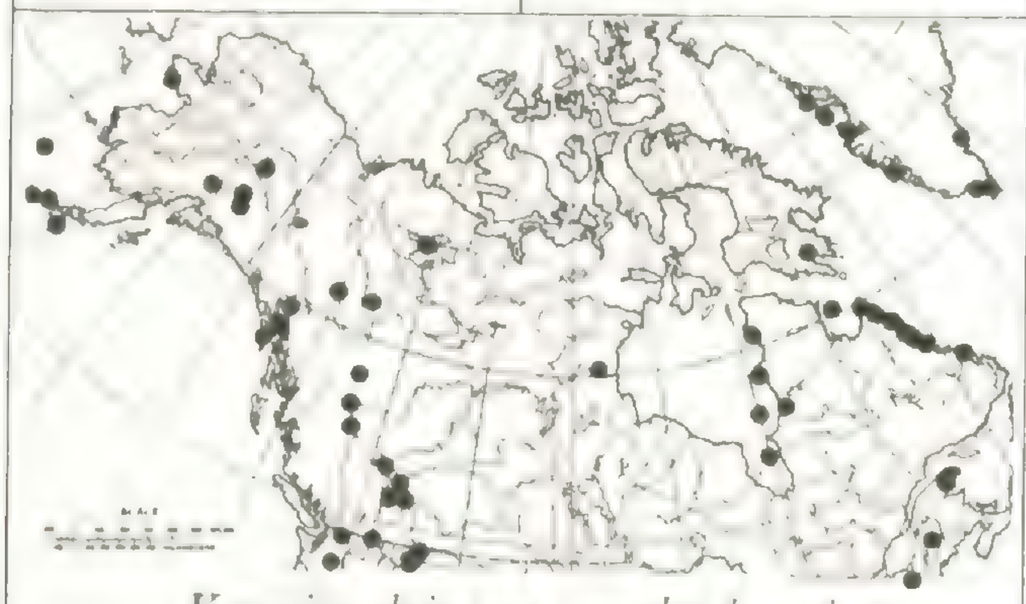
*Polemonium acutiflorum*



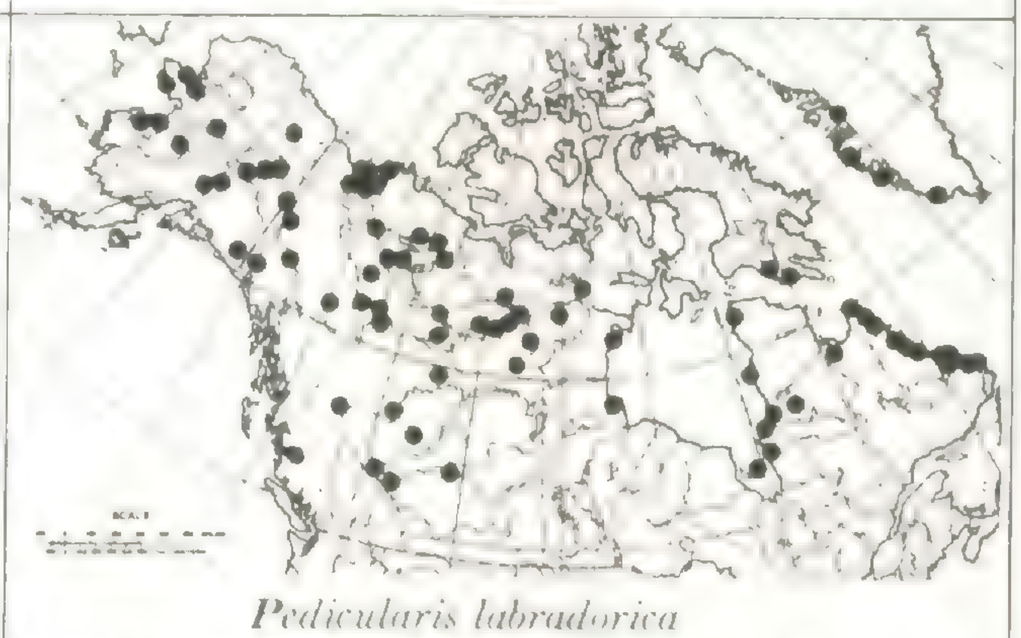
*Myosotis alpestris*



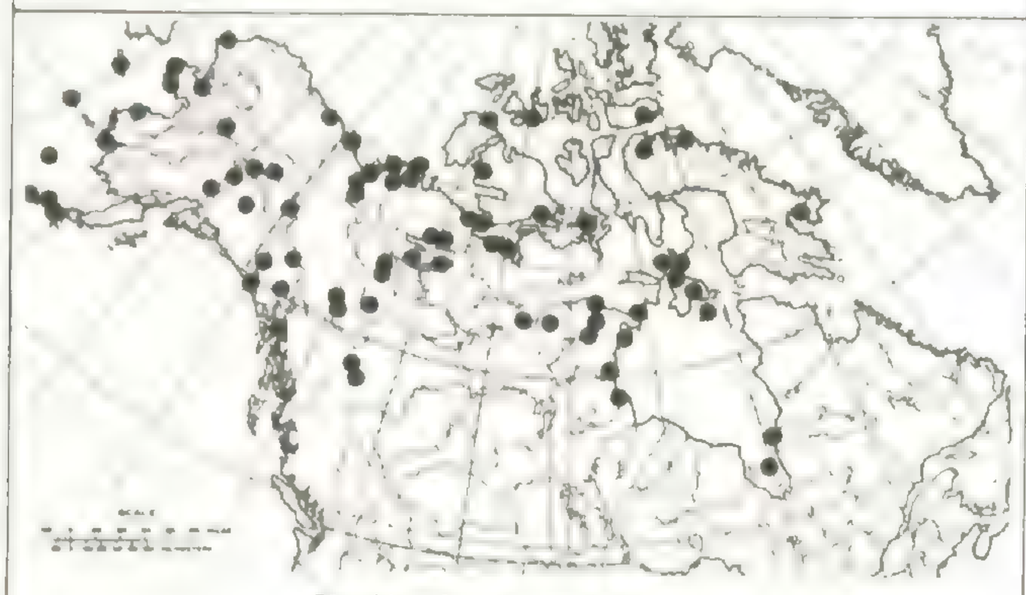
*Mertensia paniculata*



*Veronica alpina var. unalaschcensis*



*Pedicularis labradorica*



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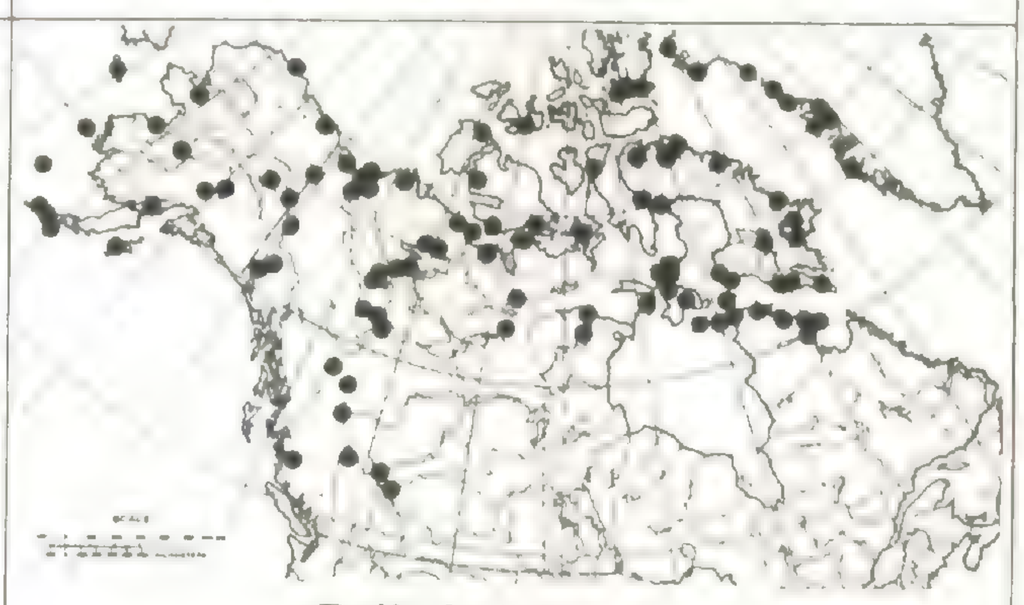

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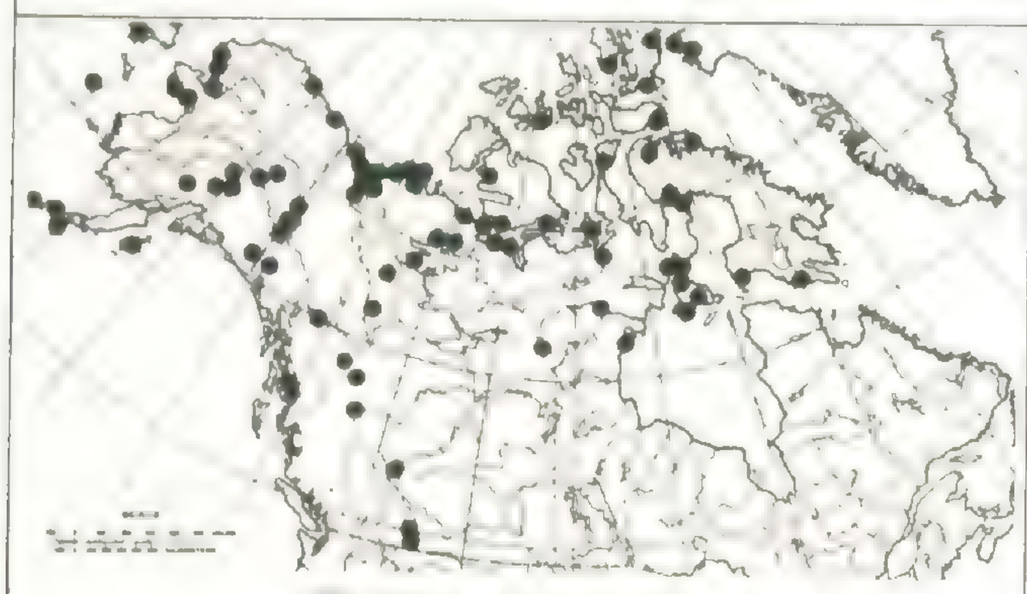

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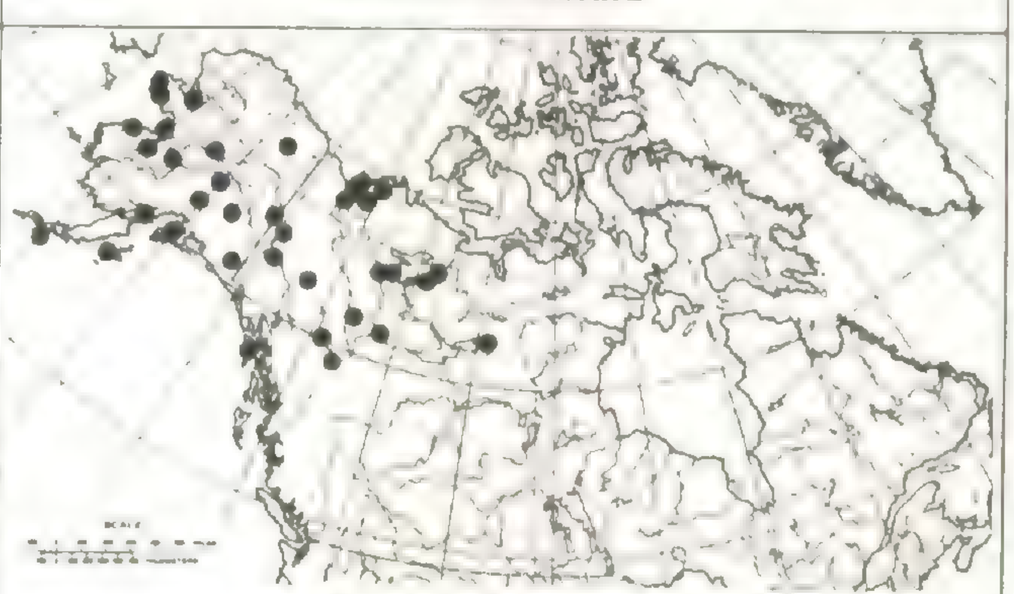

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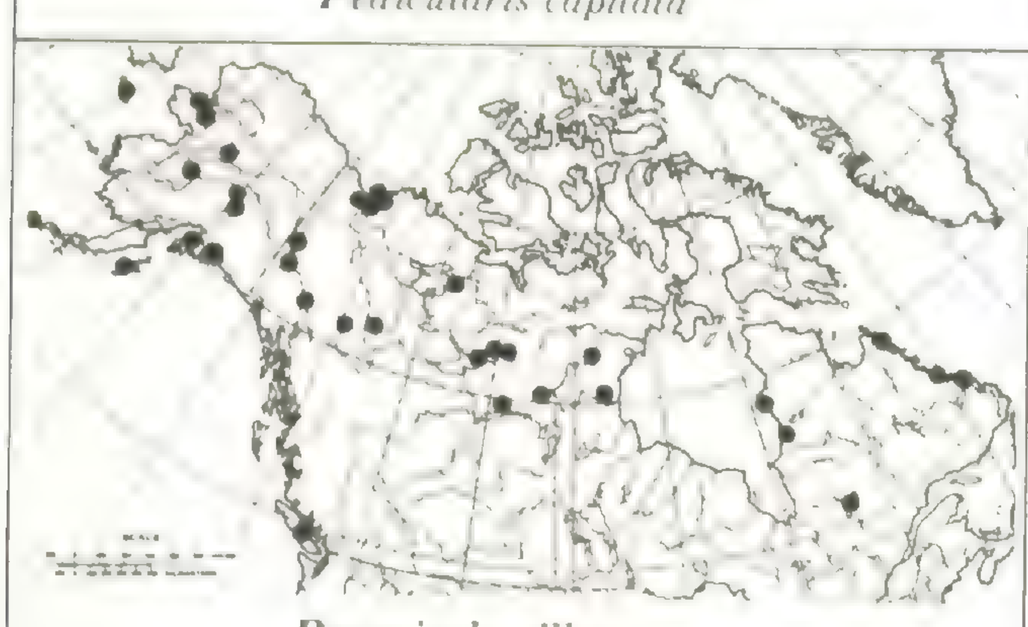

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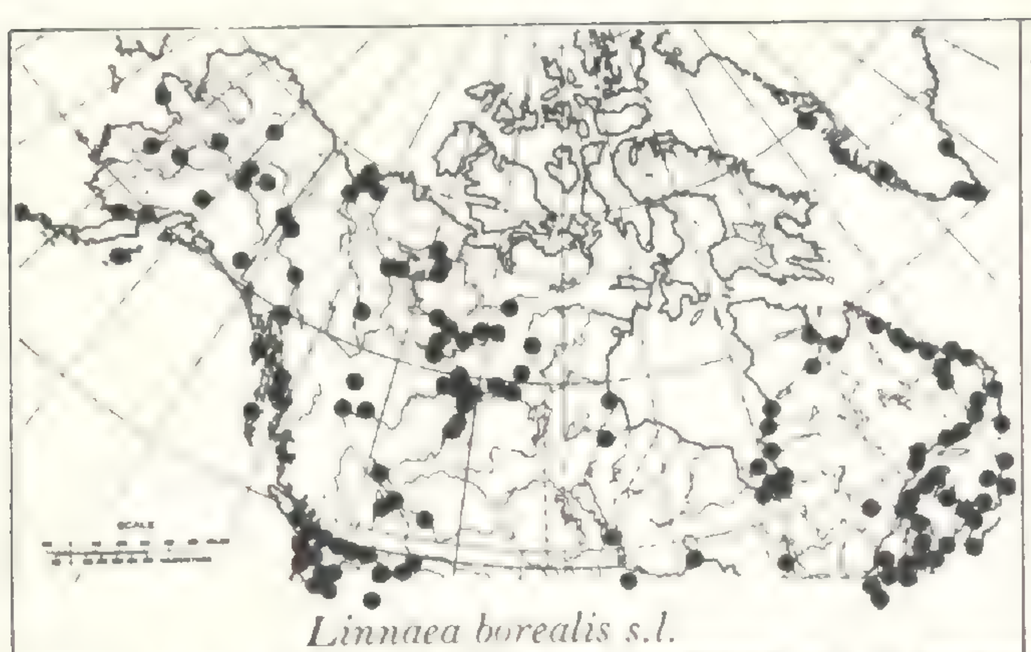

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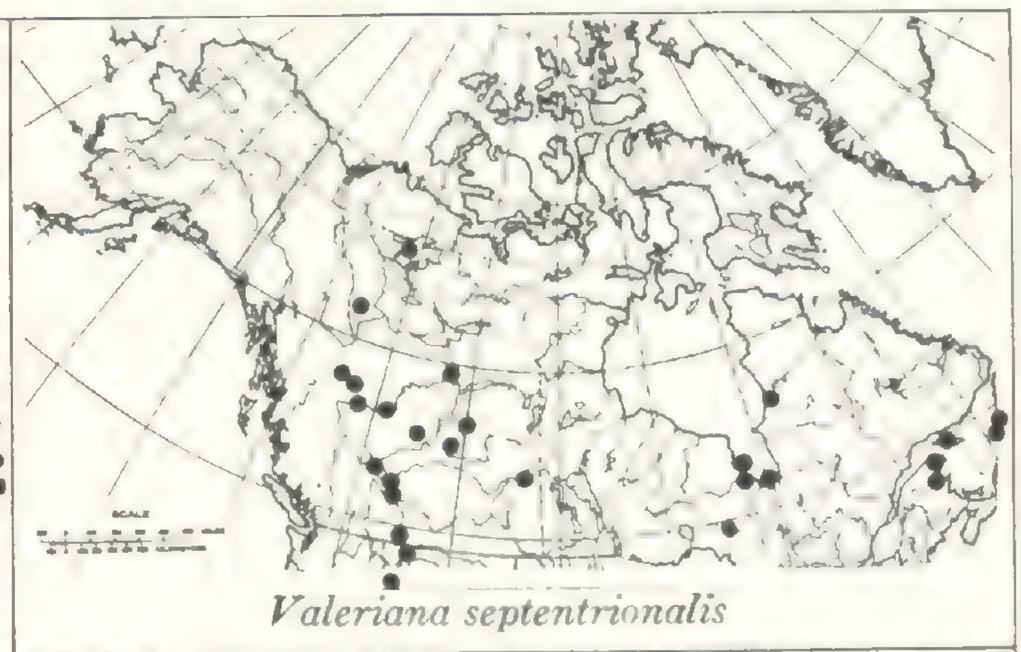

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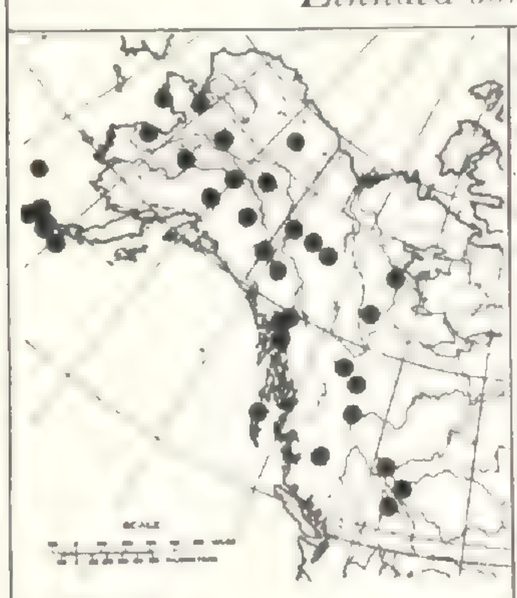

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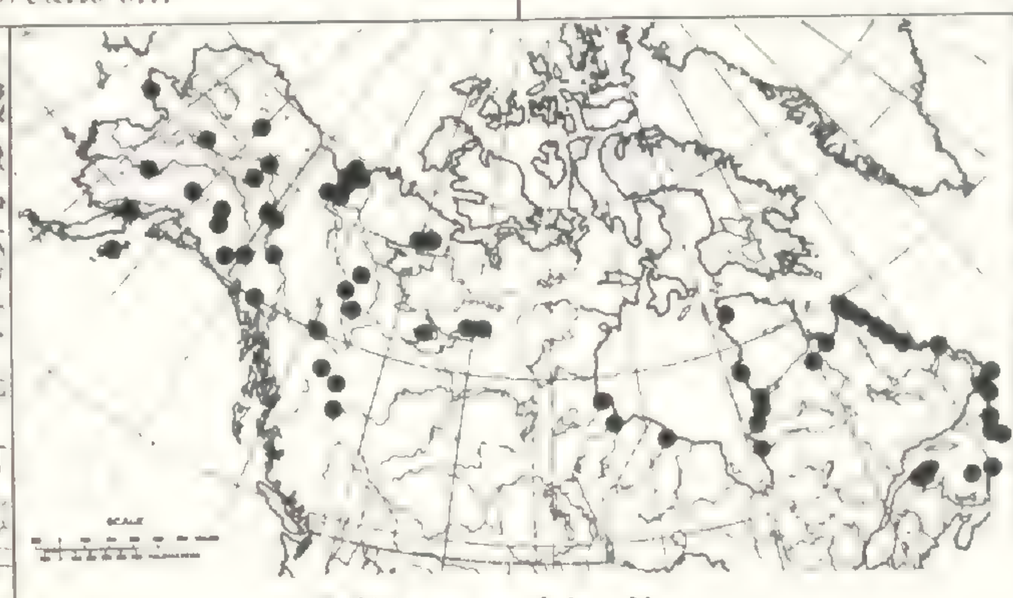

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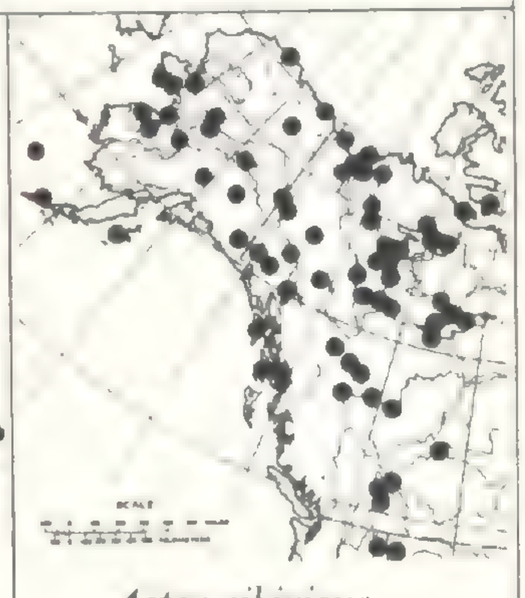

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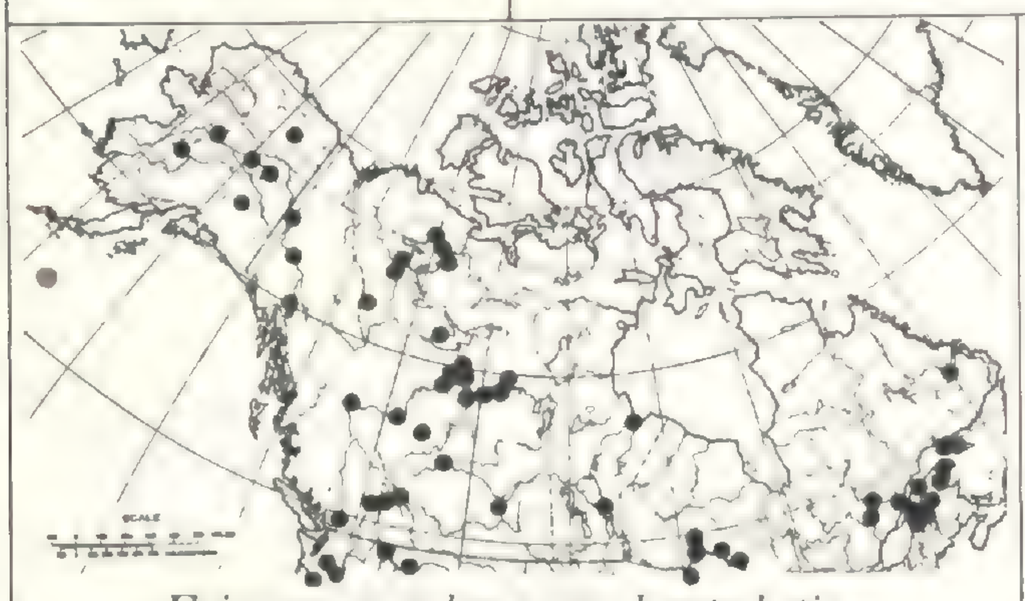

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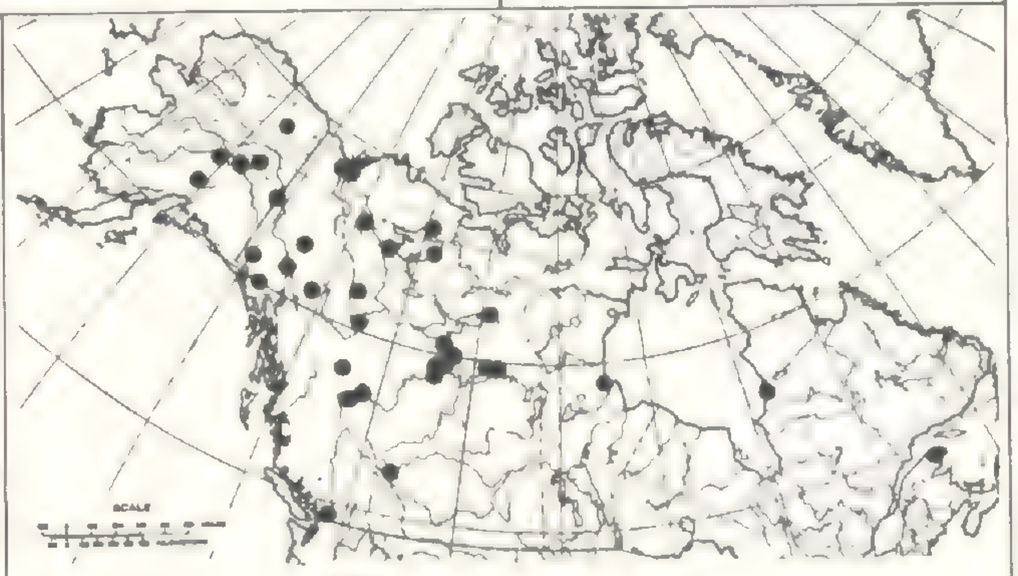

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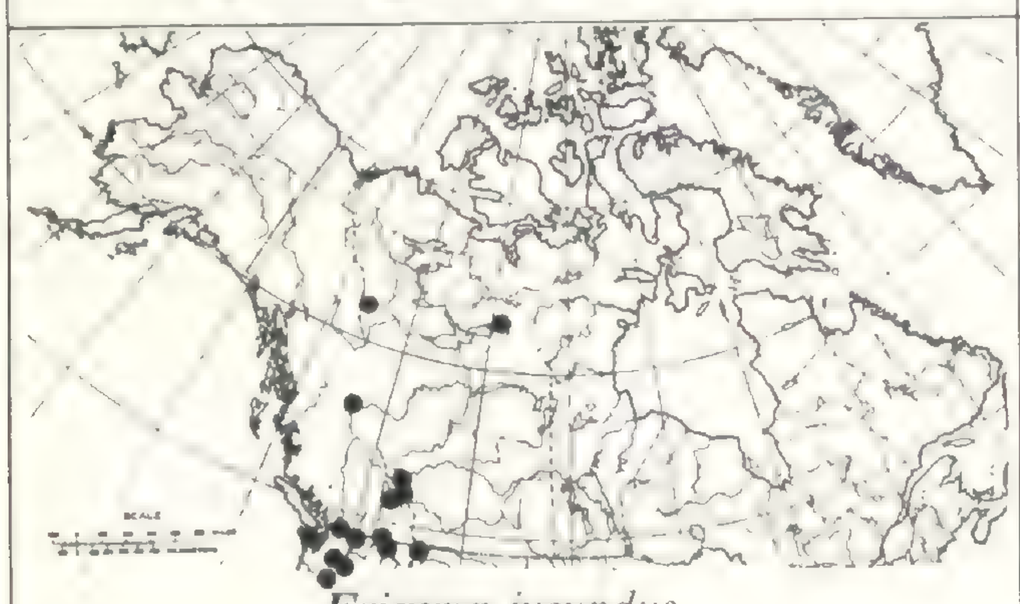

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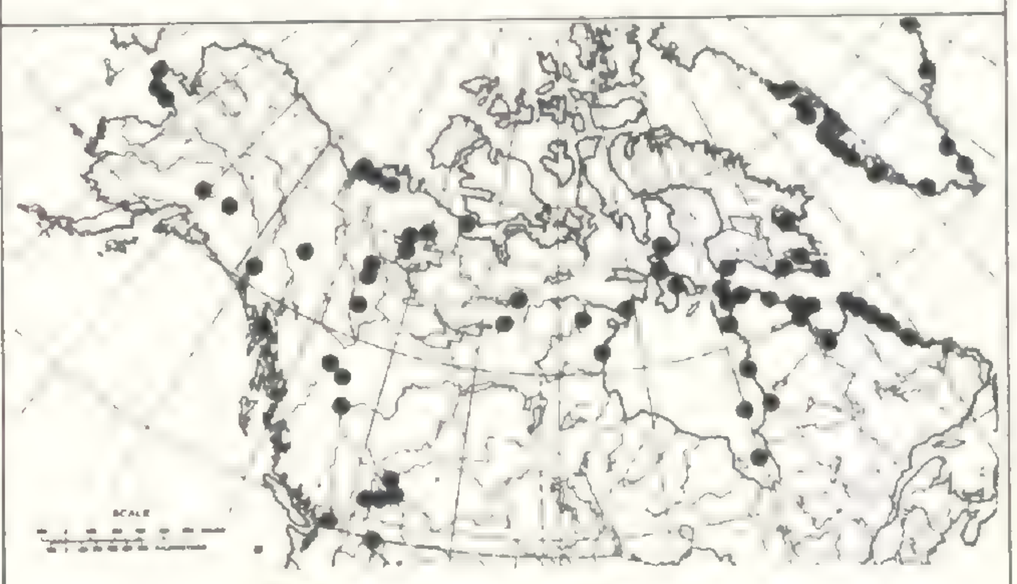

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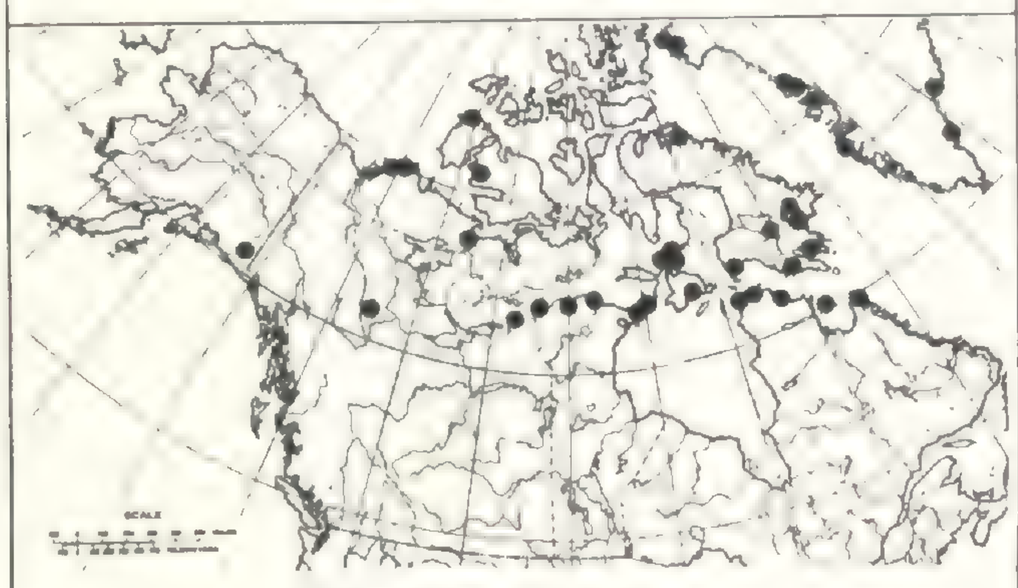

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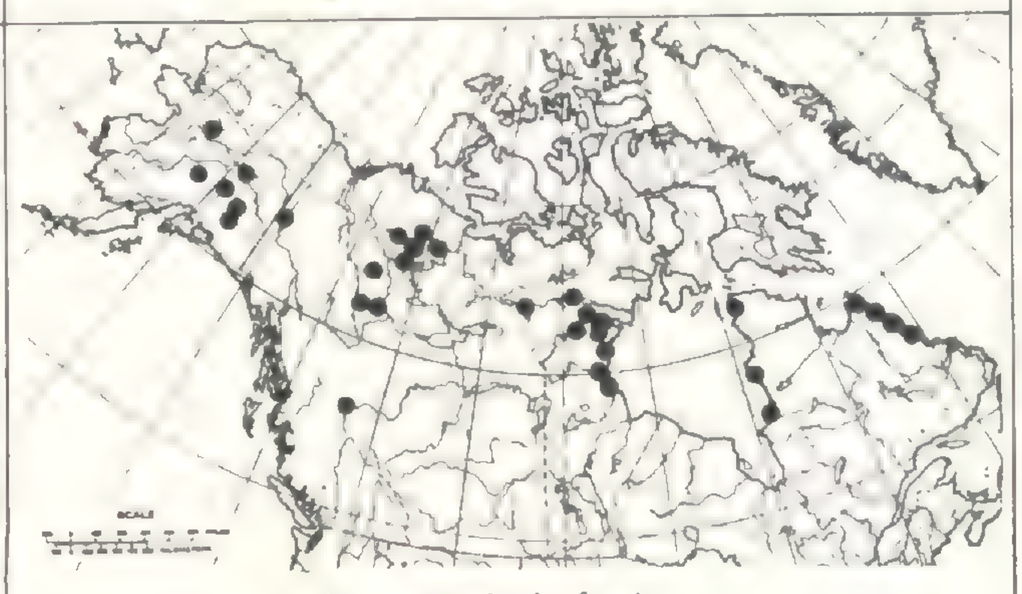

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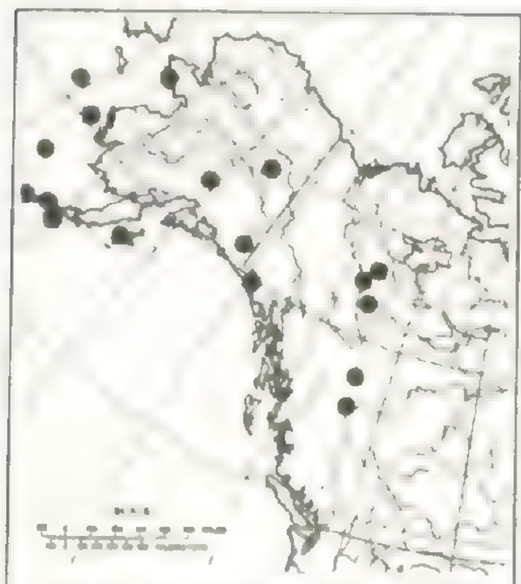

*Antennaria monocephala*

*Antennaria media*

*Antennaria subviscosa*

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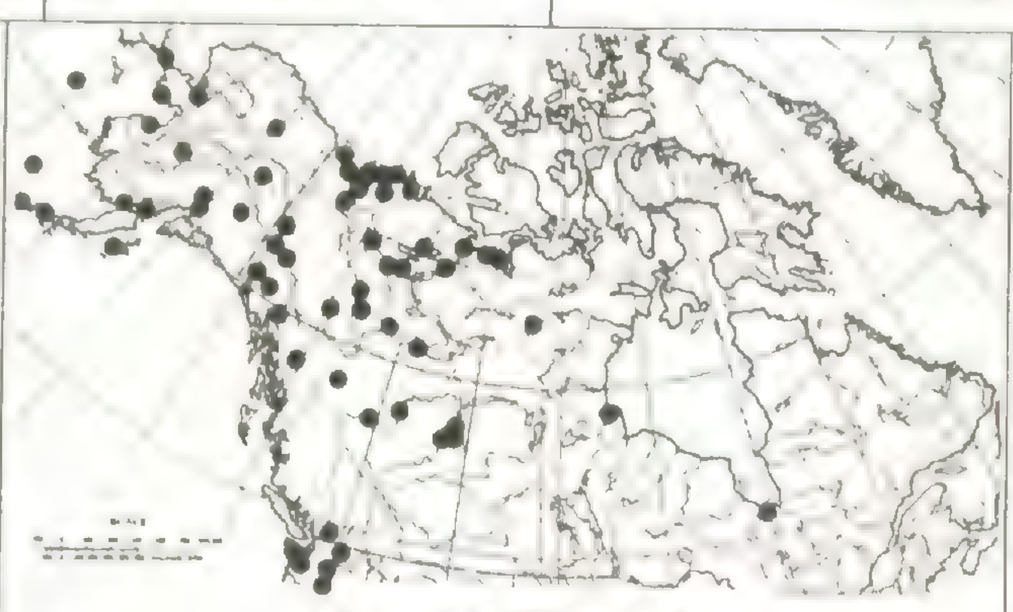

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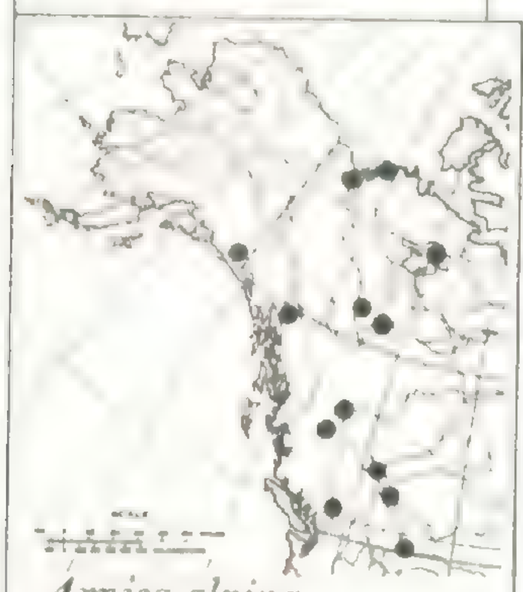
*Petasites frigidus*



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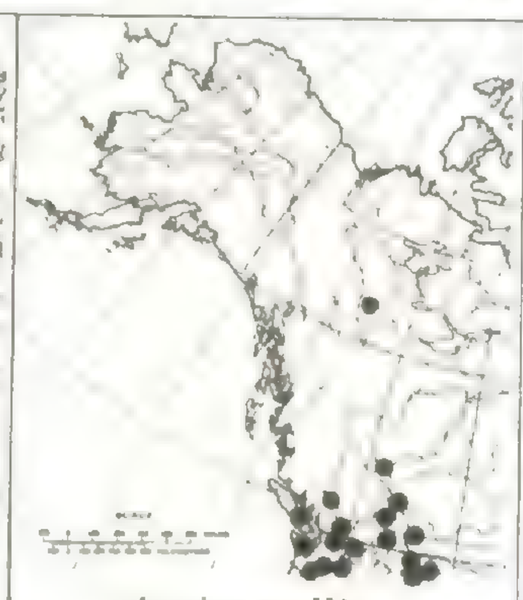
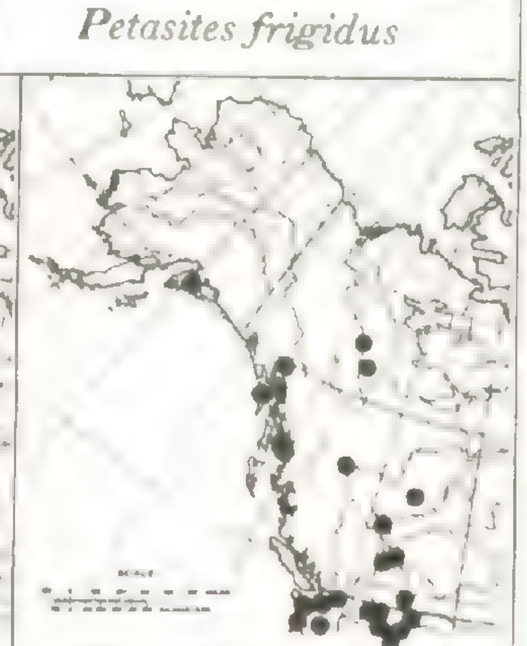
*ssp. tomentosa*

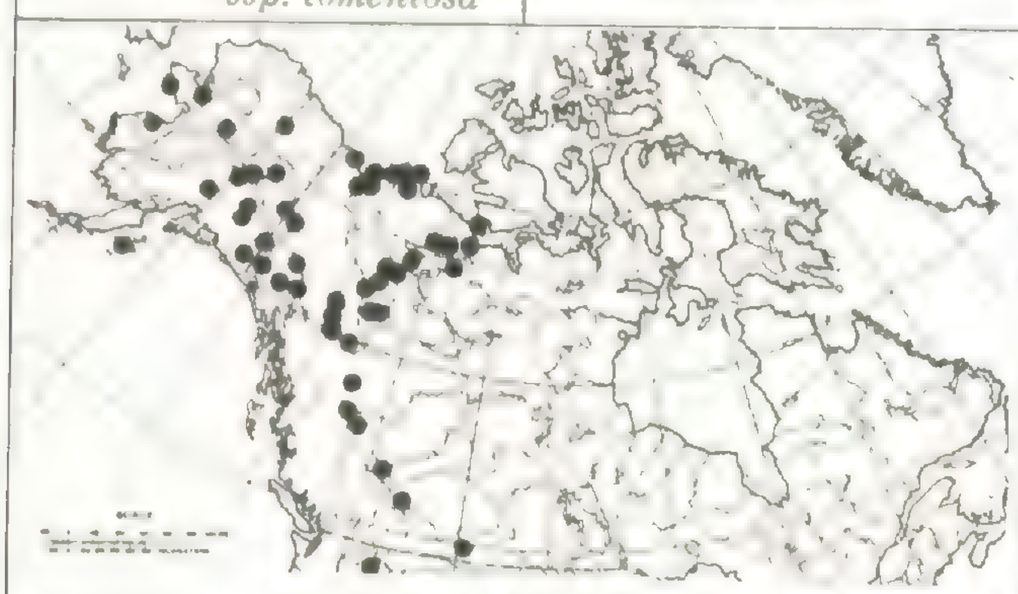


*Arnica mollis*

*Arnica Lessingii*



*Senecio triangularis*



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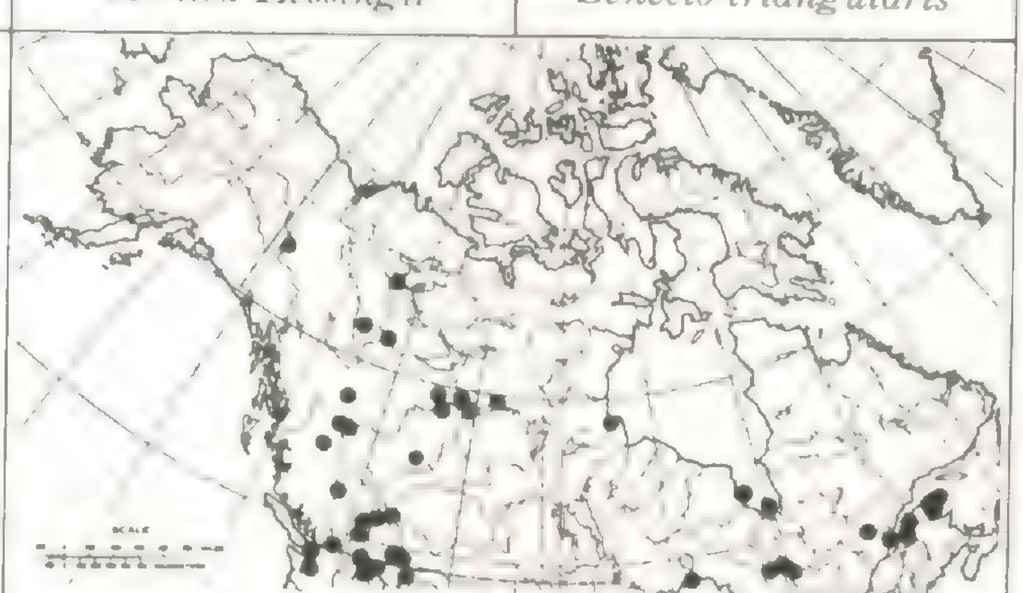

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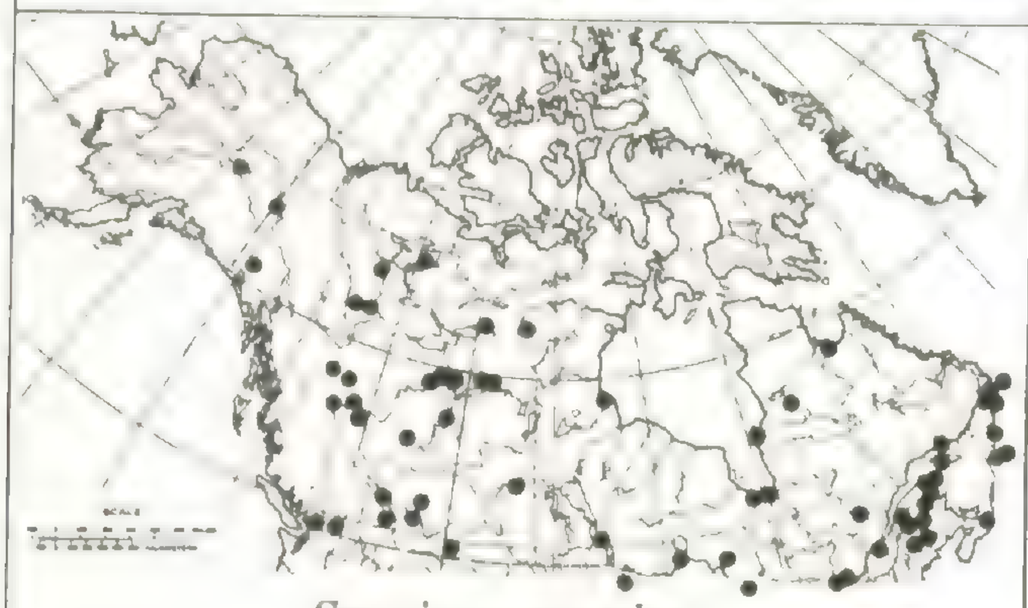

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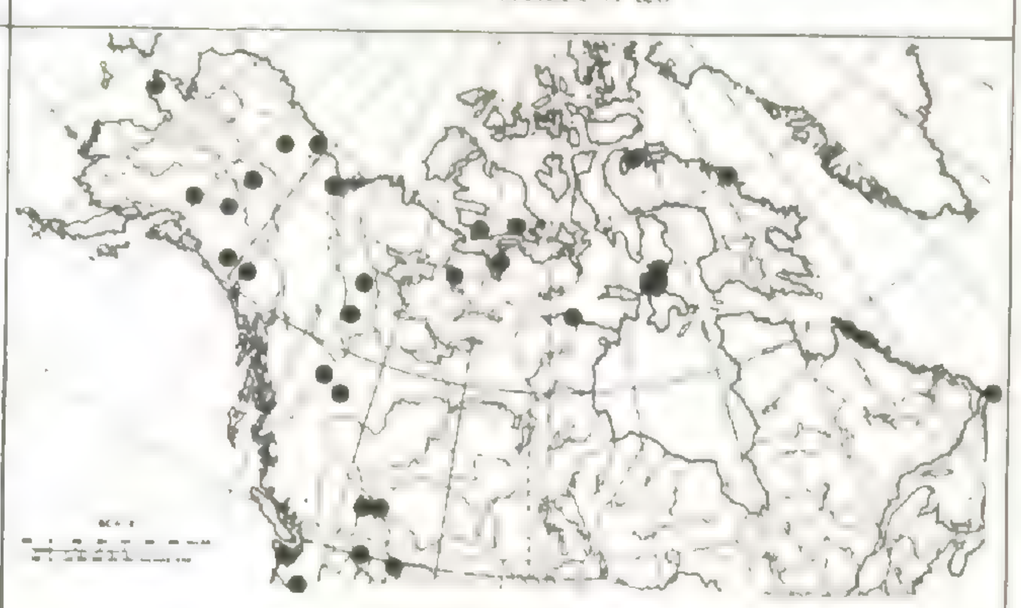

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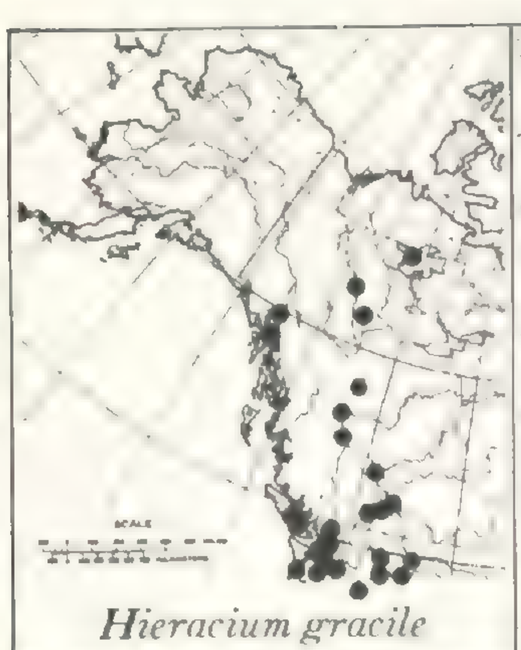

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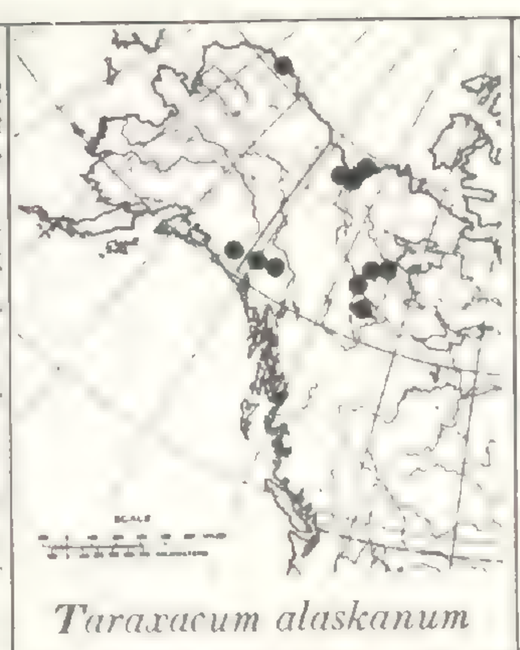

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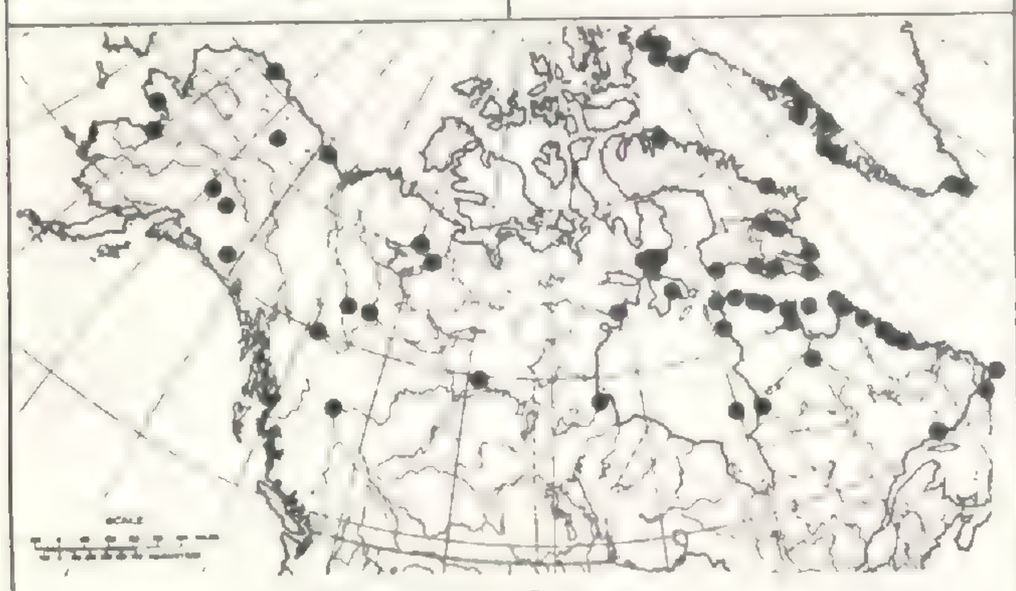
*Taraxacum ceratophorum*



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